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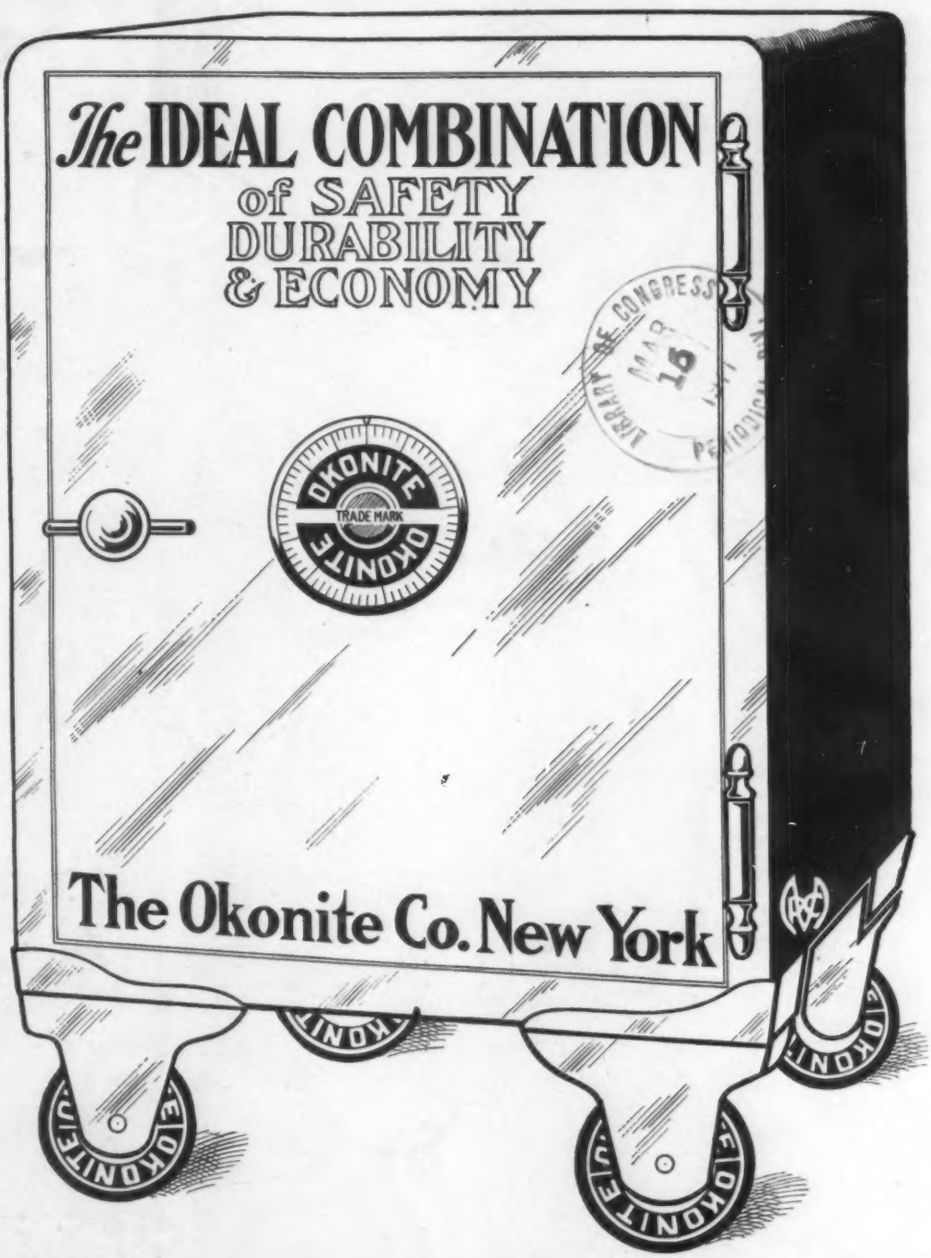

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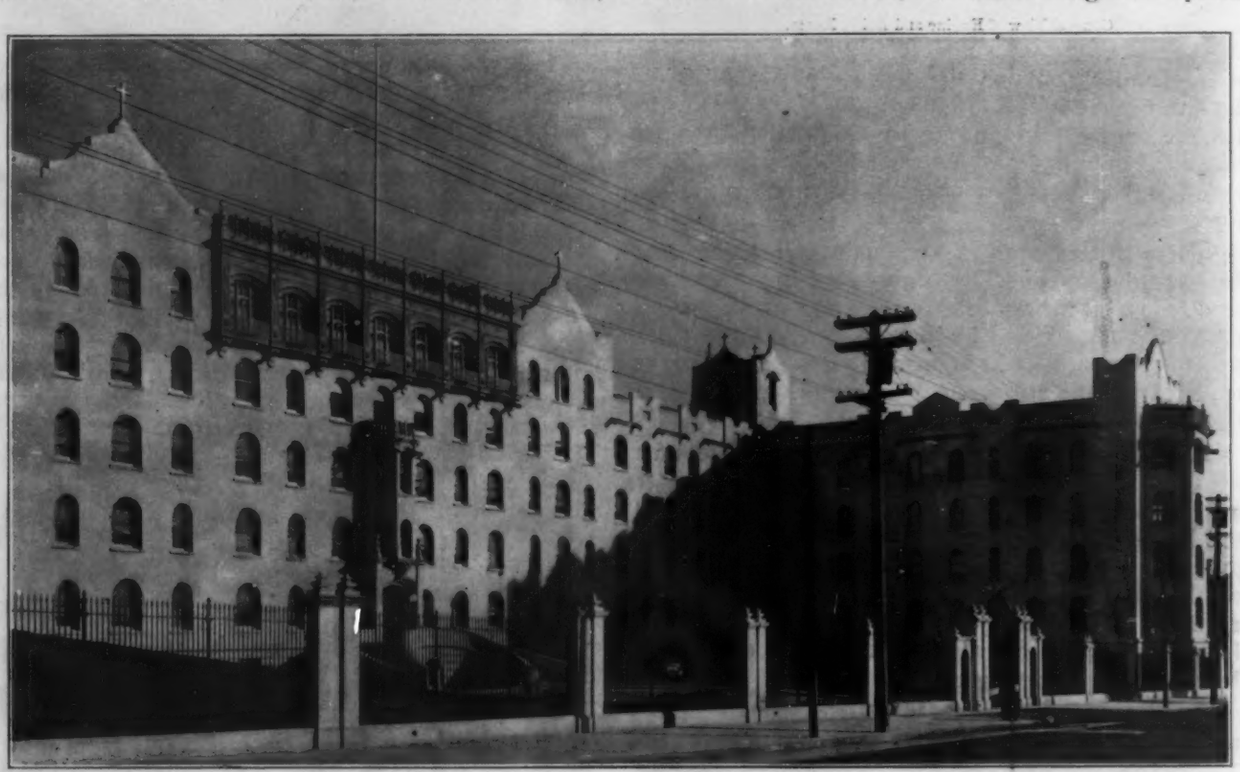
ST. MARY'S HOSPITAL POWER PLANT

The field of operation for an isolated power plant included in the equipment of quasi-public buildings is nowhere better exemplified than for use in the modern hospital. Here electricity is put to scores of uses and the auxiliary features of the plant, i.e., the distribution and circulation of steam, hot and cold water, compressed air or vacuum, together make almost every condition of operation and action except, of course, the human element, dependent upon the power plant.

The equipment of St. Mary's hospital in San Francisco is perhaps as complete and thorough as modern science can dictate; the arrangement, unlike many isolated equipments having been consistently worked out to accomplish the best results in efficiency, ample space, light, air and general accessibility.

The hospital is as yet unfinished, in that several more wings are to be added as requirements may necessitate. The power plant is therefore designed for additional units to provide for increased service.

The building is a fireproof reinforced concrete structure of six stories, the finish being in a Spanish Renaissance type of architecture, the color scheme pure white. Placed within spacious grounds, the general effect is pleasing and gives to the institution an air of cheerfulness which is of particular value in a hospital.

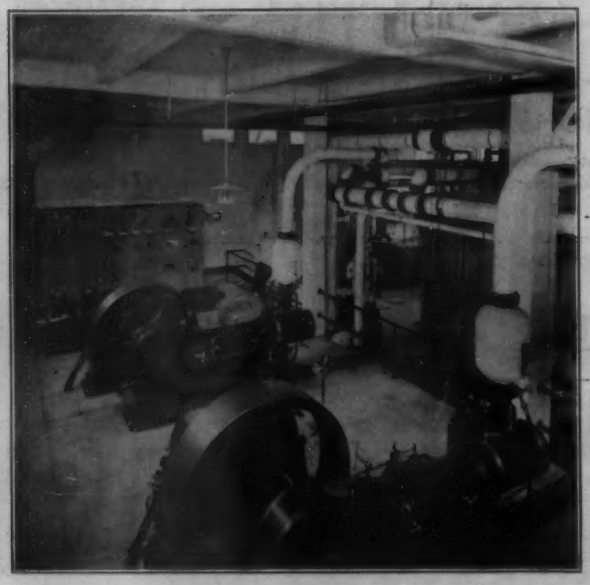


St. Mary's Hospital, front view showing Main Entramce.

That part of the structure containing the power plant, contains also the kitchens and accessory departments; it is two stories high and is detached from and in the rear of the main buildings.

The power plant occupies the ground floor which

is in reality a basement as it is a few feet below the ground surface. The engine and boiler rooms are one large room, about one-third of the space being occupied by the generating sets and switchboard, while



General View of Engine and Boiler Room.

the remainder contains the boilers and auxiliaries. The latter space is at a lower level by about three feet than the engine floor and an iron railing divides the spaces. Adjoining the engine and boiler room is a room devoted to various tanks, machine and carpenter shops, etc.

There are at present two main generating sets which are duplicates. The engines are Brownell high speed non-condensing, the bore and stroke being 13x14 in. They are fitted with Rites inertia governors and direct connected to General Electric six-pole, 75 kw., 250 volt direct current generators, operating at 275 r.p.m.

Set transversely between the nearest engine unit and the switchboard is a 30 kw. motor generator for supplying direct current when it is not desired to run the main generators. This set consists of a 250 volt direct current generator, coupled to a 50 h.p. two-phase induction motor operating from the regular service lines of the power company. It is possible, when desirable, to run this motor generator in parallel with the generating units.

There is in addition to the motor generator, a balancing set consisting of two 7 kw. direct current generators; this is for the purpose of balancing the load on the three-wire lighting system.

A second motor generator supplies direct current at 110 volts for the operation of signal bells and, together with a storage battery, is controlled through a panel board mounted directly over the set. This motor generator consists of two 1 kw. direct current machines, the one taking current at 220 volts and the other delivering at 110 volts.

A switchboard of six Vermont blue marble panels is placed at the end of the engine space and parallel to the engines. The first two panels control the main generators, and are equipped with the usual switch, circuit breaker and ammeter, there being one swinging voltmeter for both panels.

The third panel controls the balancer set; the fourth the motor generator set, there being switches, ammeters and circuit breakers for both the induction motor and the direct current generator. The fifth and sixth panels control respectively the power and lighting circuit. On the lighting panel, the main switch is double throw, enabling the use of direct current from the plant or the alternating current from the outside source. A trunk switch on panel three is provided to connect the power and lighting circuits, or by opening, to enable the power to be derived from one generator and the lighting from the other.

A master clock with circuit board, operated either by storage battery or from the 110 volt circuit, governs all clocks throughout the buildings.

There are two boilers which occupy the central part of the boiler space, leaving an opening on one side for the installation of additional boilers, while the space on the other side is taken up with the various auxiliaries. The boilers are Franklin water tube, and are rated at 132 h.p. each. The heating surface of each is 1328 square feet. The pressure maintained on the boilers is 125 lb.

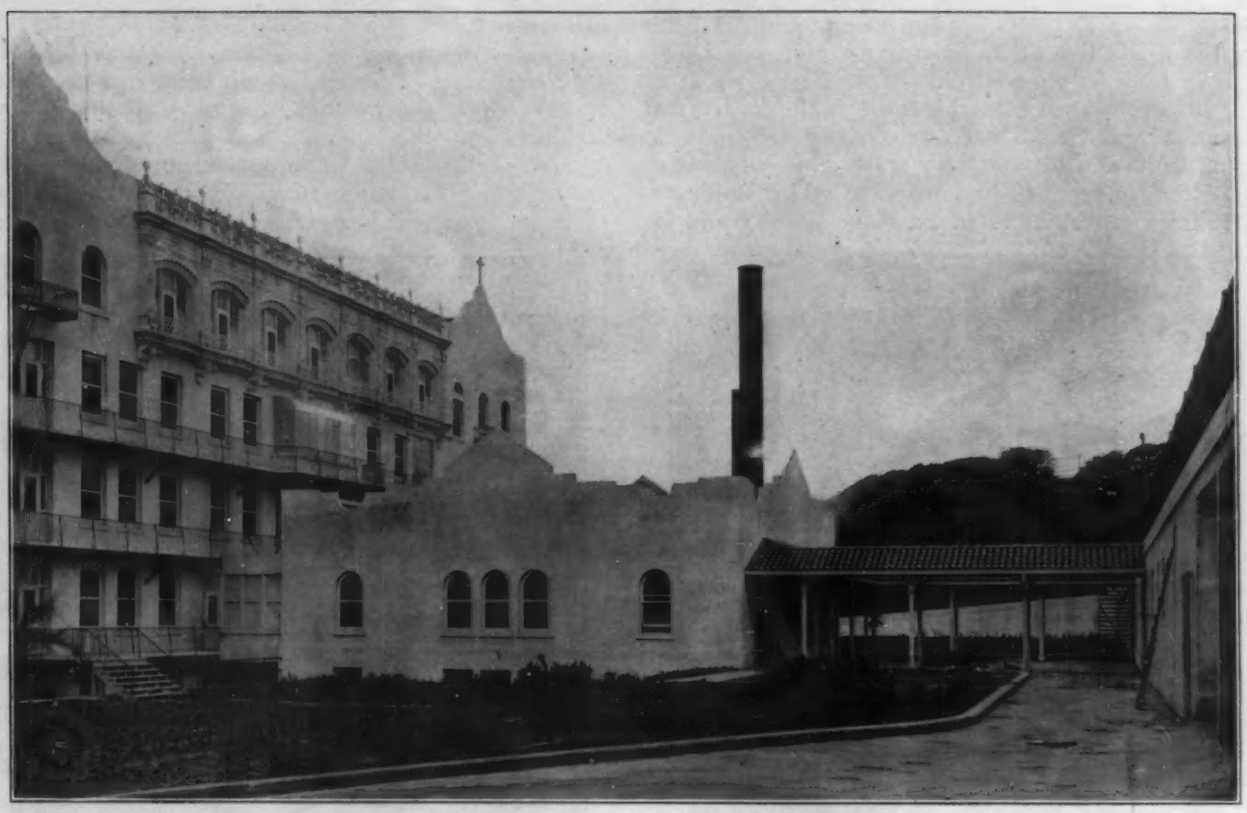
The furnaces are equipped with Wilgus oil-burners.

Exhaust steam from the engines is delivered directly into the house heating system, which provides for both direct and indirect radiation. The system operates at a pressure of from 1½ to 2 lb; steam returned on a wet vacuum system is delivered to a Cochrane feed-water heater. This is placed next to the low wall which divides the engine from the boiler compartment and directly adjoining it are two Fairbanks-Morse boiler feed-pumps. Still beyond these are the two fuel oil pumps.

In the space reserved for auxiliaries next the boilers are placed two house steam-pumps, which deliver water for all purposes throughout the buildings on the

Battery of Two Franklin Boilers.

Kewanee system. This water is drawn from a well and piped nearly one mile to a 20,000 gallon tank, placed under the sidewalk adjoining the building. From this tank it is pumped as needed.



Power Plant and Kitchen Wing.

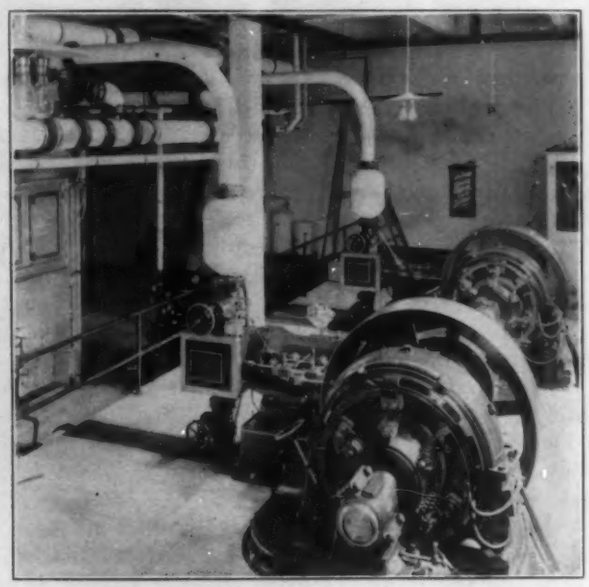
There is next a "six-house" vacuum apparatus. This machine, which is in reality a steam operated air pump, supplies the vacuum necessary in sweeping and cleaning.

The remaining apparatus is a Vulcan Iron Works refrigerating machine which is capable of supplying 600 lb. ice per day; and a steam driven brine pump, which circulates brine for refrigerating purposes in the kitchens, cold-storage rooms and therapeutic room.

Auxiliary Plant adjoining Boilers.

Placed on the wall in plain view from all parts of the plant is a Vermont blue marble gauge board. This is 3x6 ft. and contains six gauges, as follows: 1, Sterilizing steam; 2, vacuum on heating system; 3, high pressure steam; 4, city water pressure; 5, kitchen steam pressure; 6, heating steam. Passing from the engine and boiler room to the adjoining room, there is a small machine shop, and also a carpenter shop equipped with motor operated tools.

In this room are also placed a Jewell water filter, receivingtanks for the vacuum cleaning system, a



View of Generating Units from the Switchboard.

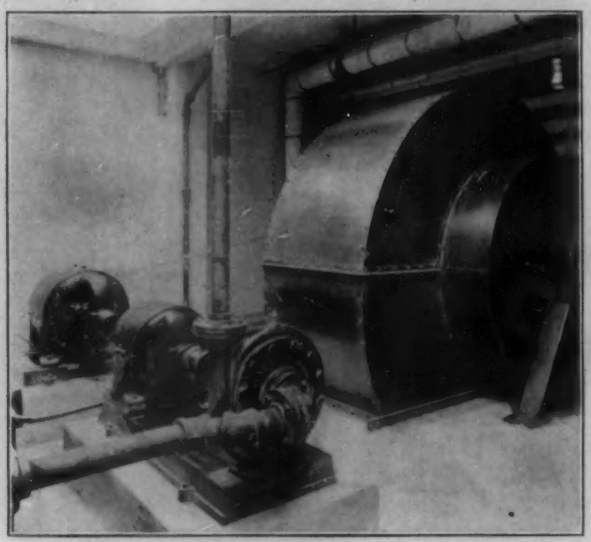
Wainwright water heater for faucets and general house use and the main and surge tank used in the water supply of the building.

One passenger and two service Otis elevators are operated by electric motors, the passenger and one

of the service elevators having magnet control, while the third, which is an ambulance elevator, has a floor selector push button control.

In an extensive marble-lined bath department, steam, hot and cold water, electricity for "electric-light" baths and for vibratory massage is supplied.

Steam is supplied to a machine which fumigates mattresses as well as to an extensive laundry and for



Motor-driven Pump for Air-washer and Centrifugal Suction Blower. Delivering Sterilizd Air.

use in cooking in the kitchens. There is also a debris incinerator.

All odor of cooking and excess heat are taken from the kitchens by an exhaust fan driven by a 2 h.p. General Electric motor, and a 3 h.p. motor of the same make drive an ice-cream freezer and a sausage machine.

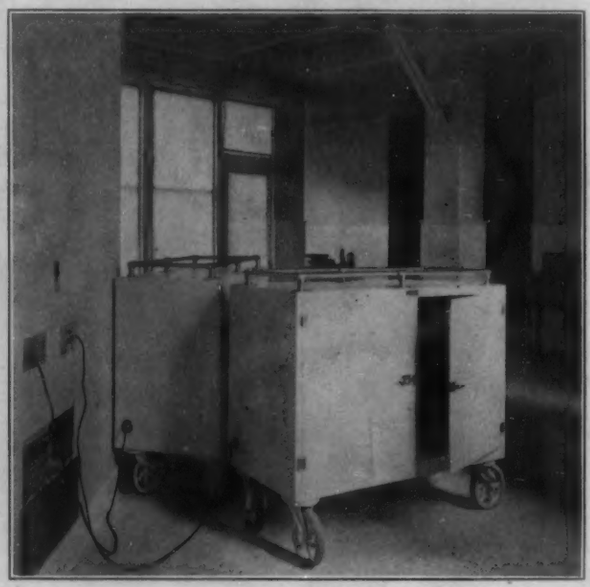
In a hospital the necessity of fresh air at a proper temperature, which may be regulated at will, is one of the greatest importance. Outside air is drawn through a Webster air washer by an exhaust fan. This fan placed in a closed room, tends to exhaust the surrounding air, the only ingress being through the washer. In passing through the latter the air comes in contact with a spray of water which carries away all particles of dust and gives the required humidity. A United Iron Works centrifugal pump driven by a 1 h.p. General Electric motor furnishes the water spray. The exhaust fan is driven by a 7½ h.p. motor and operates according to requirement from 450 to 900 r.p.m.

After passing through the fan, the air is driven through a heater. This is supplied with three sets of steam heating coils which allow a variation in the temperature of the air which is then delivered to all parts of the building.

A system for drawing impure air from all parts of the building is operated by an exhaust fan placed in a room on the roof. This fan and the driving motor is similar to the set just described.

Throughout the building is a comprehensive system of signal lights and calls from all rooms and here a novelty has been introduced. Instead of the familiar electric bells or buzzers, which are often annoying to nervous patients, there is, on each floor, a Westminster chime of four tones. These chimes consist of bell-metal tubes which are sounded by an electrically operated hammer. The different pitches of tone denote nurses or attendants of different grades of authority, while the number of strokes signify the individual wanted.

Another novelty is an arrangement for electrically heating the tray carriers. These carriers are of sheet metal in the form of a large box in which are



Tray Carriers and Method of Connection for Electrical Heating.

fitted shelves, the whole being mounted on rubber tired wheels. Within is a heating coil which enables food in trays to be kept warm while the carrier is being filled and during its journey to the various wards. At a convenient place near the kitchen, there are several wall plug receptacles supplying the current to heat the tray carriers and a set of baby knife switches provided directly under them control the current. This novel heating system was invented by Mr. J. Hughes, the chief engineer of the hospital and the tray carriers were supplied by the Butte Electric Company.

This plant is undoubtedly a model of its kind and much credit is due to the Compressed Air Machinery Company for its design and installation.

ELECTRIC AIDS FOR PHOTOGRAPHY.

Anyone who is working with the old-fashioned appliances still in use in many photographic dark-rooms would be astonished and delighted with the results which can be secured by the use of various electrical devices recently described in the Edison Monthly. By means of these not only can the tedious process be hastened, but it is possible to obtain finer effects in developing and printing.

A lighting innovation, the powerful aristo, is used in making enlargements. It is in an asbestos case, so that the light falls only on the photographic plate placed in the enlarging frame. By moving a lever the intensity can be changed from a comparatively low power to forty times daylight intensity. The illumination produced is stronger, steadier and gives

less heat than is possible with any other kind of light. Anyone who has done enlarging will realize the time saved in this way. In making line reproductions, in other words, those where the color is not being copied, a mercury vapor lamp gives especially satisfactory results. This light has the peculiar effect of hardening all lines; a seemingly blacker black stands out vividly from a clear white, very effective in copying line drawings. More novel than the lighting arrangement are the various electric heating apparatus that the photographic department of The New York Edison Company has adapted for its work. There is the electric fan to expedite drying, and for extra quick work, a dryer, usually seen in hair-dressing parlors, has been found extremely serviceable. Several plates on a rack can be dried at once by use of the fan, the process taking from one-half to two hours, depending on the humidity of the air on any particular day. The current of warm air from the hair dryer can be directed only on one negative at a time, but the work is done in fifteen minutes. When one considers that without these extraneous aids it frequently takes twelve hours for plates to be ready for printing, the usefulness of these electric appliances can easily be seen.

Another advantage is that it is possible to do finer work in this way. Printing from a wet plate, or from an enlargement, are old tricks where newspaper photography is concerned, but such treatment, while giving the desired speed, will never give fine results. The effect, though, of the warm air from the electric dryer on the plate aids in bringing out the details which might otherwise be lost. Even the directions to amateur photographers suggest that the films are better if dried in a warm room.

In mounting, an electric flatiron gives excellent results. This is done by use of gum tissue, which is placed between the print and the cardboard. The electric iron is then applied and a perfect piece of mounting results, since the print has absolutely no chance to curl, while crooked placing can be remedied by the application of a little more heat. Large photographic houses recommend a regular heating press, which costs at least $50 to buy, and a considerable sum to maintain. Such an equipment, however, is desirable only when an immense amount of work must be turned out, but for the ordinary shop, where two hundred prints must be mounted in a day, the electric flatiron, costing one-tenth as much, will perform the same service.

An electric radiator facilitates operations in the dark room. Hitherto many photographers have been forced to do this portion of their work in a cold room, since steam heat is too damp, and gas heating gives out too much light at the same time. An electric radiator gives dry heat with no lighting effect, and while the room is warming, water for warm solutions can be set upon the radiator. Any persons interested in seeing these improvements may secure permission to visit the photographic department of this company and see the apparatus in use and notice the results obtained.

Amateurs who are acutely aware of the length of time ordinarily consumed in the drying of negatives and prints may be interested to know how newspapers publish in their afternoon editions pictures of some event which occurred not more than three hours before. In order to do this newspaper photographic departments do not wait for their negatives to dry at all, but "print from a wet plate," as it is called.

To do this, the negative, as soon as it has been developed, is placed still wet in the enlarging frame. It does not come in contact with any printing paper, so the soft surface is not damaged. In the enlarging process, a strong light is thrown through the plate in the frame, the enlarged positive reflection being thrown on a screen some feet off. The printing paper is then put upon the screen and the photograph printed directly upon it.

While this method has the advantage of extreme speed, it cannot produce fine work, for when the plate, still wet, is put in the frame the gelatine has not yet "set," as it were, so that lines and shadings have not become clearly defined. Then when this is enlarged the muddiness of outline is increased.

This system of printing from a wet plate, combined with the quick printing, goes to account for the poor quality of so many of the pictures which appear in daily papers. This difference becomes strongly marked where some publication has a carefully prepared weekly supplement in which the photographs are extremely good, while many of the pictures seen in the daily editions are inferior. Newspapers that care about the appearance of their daily editions could adopt these various electric devices to use where the speed, though not the greatest, is required.

ELECTROLYTIC IRON[1].

BY CHARLES F. BURGESS.

During the past five years investigations have been carried on in the chemical engineering laboratories of the University of Wisconsin, dealing with electrolytic refining of iron and its use in the production of alloys. About 3 tons of iron have been refined and over 1000 alloys produced and tested. While this experimental work has been on the "test tube" or laboratory scale, it is believed that some of the results indicate the feasibility of enlargement to commercial state, and a short discussion is submitted here bearing on the question, "Can electrolytic iron be made an industrial product?"

Many old textbooks on electro-chemistry give descriptions of methods of depositing iron electrolytically, implying, therefore, that electrolytic iron is not a new product. The only use suggested, however, is for facing engraved plates used for printing. By following any of these earlier processes it is seen that only very thin layers of iron can be deposited, the coating tending to become dark, rough and powdery. It is to overcome this limitation that the work at the University of Wisconsin was undertaken, and that this has been successful, in a measure, is indicated by an iron cathode nearly 2 in. in thickness.

The manner in which electrolytic refining has revolutionized the copper industry is now an old story, and electrolysis has likewise become an industrial agent in the metallurgy of silver, gold and lead. Now,

[1] Paper read before the Chicago Section of the American Electrochemical Society, Jan. 20, 1911.

that it has been found that iron can be refined electrolytically almost as easily as copper, it is pertinent to inquire whether there is a field of usefulness for such iron. This depends upon whether electrolytic iron has superior qualities due to purity or physical condition, and whether it can be procured at low cost.

From the standpoint of purity it must compete with some notable metallurgical developments which have resulted in product such as being made by the American Rolling Mill Company in a basic open hearth process. For this material a purity of 99.94 per cent is claimed and justifiably so, as some of our analyses show. The electric furnace is another factor which is contributing largely to the control of the composition and purity of iron alloys, and the striking possibilities which are offered in this developing field cannot be overlooked in advocating the development of an electrolytic iron process.

The chief source of commercially pure iron has been and, perhaps, now is, the high grade Swedish and Norway iron, used largely as a base material for high grade crucible steel. The analyses of this material usually indicate a high purity, though frequently and erroneously calculated by difference, after determining carbon, sulphur, silicon, phosphorus and manganese. It is not uncommon to find oxides and slag to the extent of 2 per cent in this material, and this impurity undoubtedly may have an influence on the resulting alloys made from it.

We have found that electrolytic iron can be produced with a purity as high as 99.97 per cent, and, perhaps, even better, using extraordinary precautions. This record has been made by using the best commercial grades of pure iron as anodes. A few hundredths of 1 per cent of purity must be sacrificed in using anodes of mild steel or other less pure materials. Electrolytic refining offers a means of reducing or screening out most of the impurities commonly found in iron and of producing a material not only of high purity, but of great uniformity. Even though it may be shown eventually that electrolytic iron may not have a higher purity than that attainable by other methods, the uniformity of its composition should make it a valuable material as a means of eliminating many of the variables with which the crucible steel maker has to contend.

Using an electrolyte containing 40 g. of iron per liter in the form of ferrous sulphate, together with 40 g. of ammonium chloride, it has been found possible to conduct a continuous refining operation for many months at a current density of 6 to 10 amperes per square foot of cathode surface, and at a potential difference of about 1 volt. The current efficiency is very close to 100 per cent, as it is in copper refining.

This leads to the calculation that 1 kw.-h. will refine 2 lb. of iron; or a cost for power of ½ cent per pound is attainable. The costs for labor, solution maintenance and fixed charges are estimated to be not greater than the power costs, making a cost of refining of about $20 per ton. Assuming the anode material to be a mild steel costing $35 per ton, the cost of electrolytic iron would be in the neighborhood of $55. These approximate calculations indicate that this material might well compete in price with high grade Swedish iron.

Among the properties of electrolytic iron which may give it some added usefulness is its content of hydrogen and the brittleness which results from this occluded gas. This hydrogen may be of some service in reducing oxides in a melt. The brittleness of the electrolytic iron before the hydrogen is driven off makes it easy to break it up into pieces suitable for introduction into the steel crucibles.

COPPER MARKET SITUATION.

There has been considerable activity in copper during the last few weeks, says Copper Gossip, but price changes in local circles cover a comparatively small range. February sales of moderate volume indicate a conservative inquiry from domestic melters, but the increase in actual buying is not great enough to bring about an advancing scale of prices above 12½ for electrolytic. At the same time the rate of home consumption is quite good considering the season of the year, but it will take more urgent demand on the part of manufacturers to create a pronounced effect upon the market.

With the approach of spring active inquiries for larger tonnages are expected. An increase in new business and better specifications for both raw and semi-manufactured products should stimulate trade the next three months. The danger is that when improvement gets well started some sellers may be inclined to rush the advance and check business in that way before the danger boundary is past. It is very probable that copper will emerge from the difficulties which have beset it sooner than some pessimistic persons anticipate, but it goes without saying that a moderate recovery based on genuine improvement will be safer and more satisfactory than the attempt to force matters artificially.

During the last two years the production of marketable copper by the refineries of the United States amounted to 2,857,525,176 pounds, a quantity more than double the world's output in 1903 and 1904. The figures of refinery production in this country for 1910 were more than ten times larger than domestic output 26 years ago. The rapid growth of the copper industry in recent years marks a period of phenomenal development at the leading mining districts. The great increase of output from the porphyry properties has given the copper market a big set back. These bodies of disseminated ores are worked by steam shovels, and the comparative ease with which they are handled tends to unusually cheap operating cost. The old fissure mines are more costly to work than the low grade propositions where conditions are exceedingly favorable for cheap mining.

The drastic decline in the market price of copper from the high figures of 1906 and 1907 has brought the selling price at present down to a strictly reasonable basis. At current values copper is certain to be in heavy demand by the manufacturers of the world. If the market were kept more liquid that fact in itself would tend to maintain consistent activity much better than by forcing buyers to pay a pegged price. The habit of fixing an arbitrary price gives no index of actual conditions, but by this mistaken method trading is made obligatory at the sacrifice of intelligent judgment and by ignoring natural laws.

MOTORS IN TELEPHONE EXCHANGES.[1]

BY C. W. BURKETT.

In the more modern common battery telephone exchanges of the Bell system, both direct and alternating current motors are used very generally. The specific uses for motors in such telephone exchanges are as follows:

1. Alternating current motors of both single phase and poly-phase types and constant potential direct current motors are used for driving generators for charging storage batteries, which in turn supply the talking current and current for signalling purposes. These motors will vary in size from about 1½ to 48 horsepower and if direct connected to the generator will vary in speed from approximately 50 to 2000 revolutions per minute.

In that it is absolutely essential in a telephone exchange to have a reliable source of power, frequently two motor generator sets are provided for charging the main battery; one of these usually being direct current and the other alternating current, if these two sources of power are independent and available. If this is not the case, and if gas is available, one of the generators is usually driven by a gas engine.

2. A small motor in the larger common battery exchanges is usually provided for charging a smaller storage battery which is placed in series with the main storage battery to provide 48 volt current for use on long distance connections. This motor is usually of a capacity from 1 to 5 horsepower.

3. Usually two sets of motors, one either alternating or direct current, supplied from the city power circuit, and the other supplied from the storage battery, are provided for operating the service motor-generators which provide 30 volt direct current for operating service meters, used in connection with the recording of telephone calls. These motors vary in size form 1 to 2 horsepower.

4. In the larger exchanges, motors are provided for driving twin generators which supply 110 volt current, both positive and negative, for the operation of coin collectors, or what are usually termed "pay-back nickel machines." These motors will vary in size from ½ to 2 horsepower.

5. Both alternating and direct current motors from independent sources, are provided for operating ringing generators which are used to supply the current for ringing subscribers' stations and ringing on toll and "ring-down" trunk lines. These motors will vary in size from about ½ to 1 horsepower.

6. In all of the larger exchanges, motors are provided for driving generators for supplying 65 and 110 volt current for the operation of telegraph instruments used in conjunction with long distance telephone lines.

7. In many of the modern exchanges a ringing dynamotor is provided instead of a ringing generator in connection with a motor. This machine consists of a double wound armature and a single field, and is practically a rotary converter. Direct current for the operation of the machine is usually obtained from the main storage battery and the alternating current side supplies single-phase alternating current at approximately 75 volts and 16 cycles. These machines are usually two pole and are operated at 1000 revolutions per minute, They will vary in size from approximately 1/6 to 1 horsepower.

8. In the larger multi-office exchanges and particularly where considerable long distance or toll business is transacted, motors are provided for the operation of either a belt conveyor or pneumatic ticket distributing system. This system is used for the distribution of tickets from the recording to the toll line operators. These motors will vary in size from 1 to approximately 20 horsepower. The largest installation of this sort on the Pacific Coast is in the Kearny office of our San Francisco exchange. In this exchange we have a vacuum conveyor system which requires approximately 20 horsepower for its operation. Two motors are provided; one alternating and the other direct current. Either one or the other of these motors is in continual service and the other is used for reserve.

In the design of telephone power plants, it is usually found expedient to install motors which are somewhat in excess of the initial requirements. This is done in order that the entire central office equipment may be as nearly in cost equilibrium as possible. For this reason, motors for telephone use are required to conform to quite rigid specifications. Particularly is it necessary that the efficiency curves from approximately ½ to full load be flat as possible. It is also necessary in telephone motors that the speed limits be kept close, as the adjustment of telephone signalling apparatus, in common battery exchanges, is close and also, a difference in transmission will result if any considerable variation in voltage of the current supply be permitted.

We have in use a number of Western Electric direct current motors, Western Electric alternating current motors, Westinghouse and General Electric alternating current motors, both single-phase and poly-phase, Emerson single-phase motors for driving the smaller apparatus, as ringing machines and coin collecting machines, and Wagner single-phase motors usually used for driving the charging generators.

For a common battery telephone exchange of 10,000 subscribers, motors aggregating 100 horsepower for both operation and reserve will be required, while an exchange of 1000 subscribers require motors less than 10 horsepower.

Direct Current Motors.

The requirements for direct current motors upon which we have usually insisted are as follows:

Efficiency: The minimum efficiency for varying sizes is shown on the attached curve.

Type: The type of motor is, in every case, constant potential.

Heating: The heating requirements are as follows:

The motor should be capable of delivering continuously its rated output at the specified voltage without a rise above a room temperature of twenty-five degrees Centigrade.

Field and armature, by resistance measurement, fifty degrees Centigrade and by thermometer, forty-five degrees Centigrade.

Commutator and brushes, by thermometer fifty-five degrees Centigrade.

[1] Paper presented before San Francisco Section A. I. E. E., Feb. 24, 1911.

Bearings and other parts of the machine, by thermometer forty degrees Centigrade.

Further, the motor should be capable of running for two hours at a twenty-five per cent overload without injury to any of the parts.

Brushes: The motor should be provided with brush holders and carbon brushes of a type which will ensure satisfactory operation. The current density in carbon brushes should not exceed 35 amperes per square inch. For motors operating at less than 30 volts, metallic gauze may be used.

Commutation: The motor should run without injurious sparking from no load to 25 per cent overload without alteration of the position of the brushes.

Bearings: The motor should be provided with self-oiling and self-aligning bearings.

Speed: The speed should not vary more than 5 per cent between no load and full load, when the voltage of the supply mains is kept constant at the normal voltage. Variation of speed, due to a variation of 5 per cent above or below the normal voltage, should not exceed 5 per cent above or below normal.

When motors are used in combination with ringing generators, the motor should be capable of driving the generator under all specified conditions of speed and load.

Mounting: Depending upon whether the motor is direct connected to the generator or belt connected. It should, in the first case, be mounted on a rigid sub-base of cast iron or I beam construction, which sub-base should be common to the motor and the generator to which the motor is connected; or in the second case, the pulley should, of course, be of proper dimensions and width of face for belt driving.

Starting Box: In general the motor should be provided with a fireproof starting box and this box should be equipped with both an over-load and no voltage release. The starting box is usually mounted at the rear of the power switchboard.

Insulation: The insulation between the armature and field windings and between these windings and the frame, and, if direct connected, between the two machines and between the motor and the sub-base should not break down when subjected to the following mean effective differences of potential of alternating electro-motive force continuously applied for one minute.

Rated Terminal Voltage	Capacity of Motor	Testing Voltage
Not over 400 volts	Under 10 kilowatts	1000 volts
Not over 400 volts	10 kw. and over	1500 volts
400 to 800 volts	Under 10 kw.	1500 volts
400 to 800 volts	10 kw. and over	2000 volts

Alternating Current Motors.

Type: The motor should be of the self-starting induction type and should operate satisfactorily on an alternating current circuit of the voltage, frequency and number of phases specified.

Heating: The motor should be capable of delivering continuously its rated output at the specified voltage and frequency without exceeding the following rise above a room temperature of twenty-five degrees Centigrade.

Electric circuits, by resistance fifty degrees Centigrade.

Bearings and other parts of the machines, by thermometer, forty degrees Centigrade.

In squirrel cage or short circuited armatures, fifty-five degrees Centigrade, by thermometer, may be allowed.

Starting Torque: The motor should develop sufficient torque to start the machine to which it is connected, the machine being at no load.

Insulation: The insulation between the different circuits and between the primary circuits and the frame, and, if the motor is direct connected, between the two machines and between the motor and the sub-base, should not break down when subjected to the following mean effective differences of potential of alternating electro-motive force continuously applied for one minute:

Rated Terminal Voltage	Capacity of Motor	Testing Voltage
Not over 400 volts	Under 10 kilowatts	1000 volts
Not over 400 volts	10 kw. and over	1500 volts
400 to 800 volts	Under 10 kw.	1500 volts
400 to 800 volts	10 kw. and over	2000 volts

Speed: The variation of speed of the motor between no load and full load should not be more than five per cent when the voltage of the supply mains is kept constant and the frequency is normal. The variation of speed, due to a variation of five per cent in either voltage or frequency of the supply mains, should not exceed five per cent from normal.

Bearings: The motor should be provided with self-oiling and self-aligning bearings.

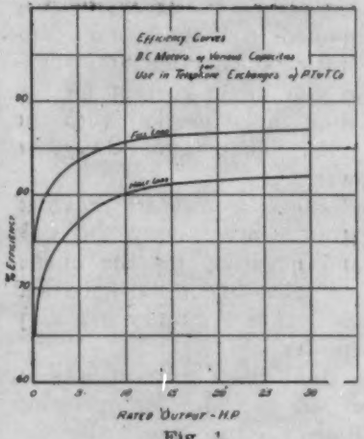
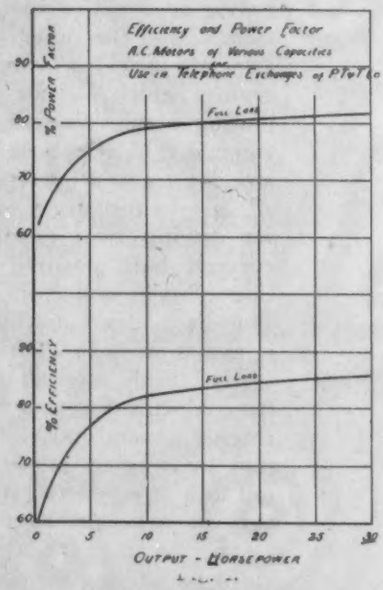


Fig. 1.



Mounting and Means of Driving: Depending upon whether the motor is direct connected to the generator or belt connected. It should, in the first case, be mounted on a rigid sub-base of cast iron or I beam construction, which sub-base should be common to the motor and the generator to which the motor is connected; or in the second case, the pulley should, of course, be of proper dimensions and width of face for belt driving.

Power Factor and Efficiency: The power factor and efficiency of alternating current motors at full load should not be less than is shown in the accompanying curves.

PHOTOMETRY OF SEATTLE STREET ILLUMINATION.

BY RAYMOND A. HOPKINS AND EARL J. BEERY.

With the recent rapid development of Seattle's street lighting good opportunity has been afforded for making experimental tests on several different lighting systems. The City of Seattle has taken steps far in advance of other western cities and is fast obtaining a degree of illumination for her streets which will rival anything in the East. The tungsten incandescent lamp has become the basis of all the new lighting. Lamps have been obtained in sizes ranging from 40 c.p. to 300 c.p., from which variety the intensity best adapted to the requirements of each individual installation is selected with precision.

One of the most satisfactory types of lighting and one quite extensively installed is that of the cluster lights. At the present time 1021 poles are lighted and 598 are under construction. The poles are of simple, neat design, unostentatious by day, and, owing to the unique arrangement of the globes in the form of a vertical triangle, plane perpendicular to curb, give a pleasing appearance at night. Three types of poles are used —a five-ball for business streets, a three-ball for residence districts and a single-ball for parks and drives.

To give some of the results obtained from tests made with a portable photometer on these five-ball clusters using both tungsten and gem lamps and also on some of the older systems of lighting, is the purpose of this paper.

The tests were made with a Sharp-Millar portable photometer. The instrument consists essentially of a milk glass, a movable tungsten battery lamp and a Lummer-Brodhun prism element with telescopic eyepiece. The milk glass can be rotated at the end of an elbow tube in order to receive illumination from any direction. The standard battery lamp is calibrated for voltage, the correct value being obtained by varying a resistance in its circuit and indicated by a voltmeter across its terminals.

For this series of tests the instrument was carried on a tripod, bringing the milk glass about four feet, four inches above the pavement. This height of the plane of illumination is about the height at which light is generally desired for seeing pedestrians, vehicles, etc., and is appropriate for these particular tests, since, as shall appear later, readings were taken in horizontal directions as well as vertical.

Four types of lighting were tested, one block of each as follows:

1. Tungsten cluster lights.
2. Gem cluster lights.
3. Enclosed arc lights.
4. Series tungsten lights.

The blocks of tungsten clusters and gem clusters selected for the tests are similar in all matters of importance and were chosen so in order to better show a comparison of the two lamps used in similar installations. The streets are red brick paved, the sidewalks gray cement, the buildings on both sides continuous and at least four stories high. Each block has four cluster poles on each side of the street set opposite each other. The poles are of the five-ball type and are provided with sand blast globes. The tungsten equipment consists of one 100-watt and four 60-watt, 115-volt, Mazda lamps, the gem of five 100-watt, 115-volt, gem lamps. Illumination readings were taken at twenty-five foot stations on lines parallel to the curb.

The blocks of enclosed arcs and series tungstens selected for testing are in residence districts. The streets are paved with black asphalt, the sidewalks are of cement. The arc equipment consists of 475-watt, 6.6-ampere arc lamps hung two to a block near the center of the street and about twenty feet above the pavement. The series tungsten lights consist of 52-watt, 6.6-ampere lamps supported two to a block from goose neck brackets, nearly over the curb, on one side of the street only, and about seventeen feet above the pavement. Illumination readings were taken at fifty foot stations on lines parallel to the curb.

During these experiments precautions were taken to secure the same conditions for the test of each type of lighting. The months of February and March were chosen and the hours of one to six a. m. Each night of the test the pavement was dry and the sky cloudy. All lights on the street other than those under test were turned off.

At each station five readings were taken as follows, each reading being checked by a duplicate, and, in the case of the arc lights, by a triplicate:

A. With the milk glass in a vertical plane and facing forward, that is, in the direction in which the stations progressed down the street.

B. With the milk glass in a vertical plane and facing toward the right.

C. With the milk glass in a vertical plane and facing backward.

D. With the milk glass in a vertical plane and facing toward the left.

E. With the milk glass in a horizontal plane and facing upward.

Thus, four readings were taken in vertical planes ninety degrees apart and a fifth in a horizontal plane.

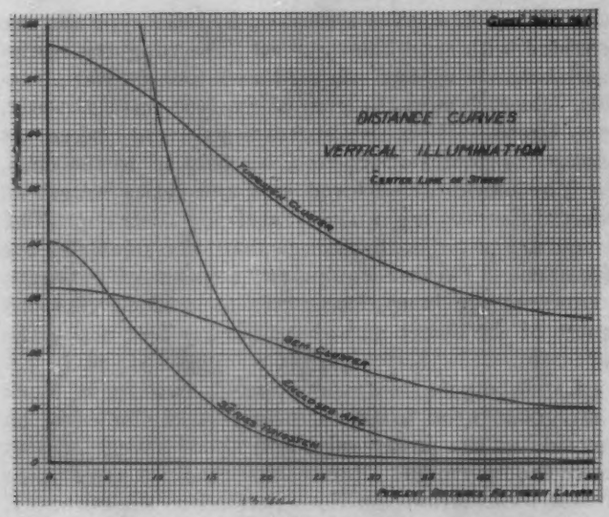
From these five readings three values of illumination have been derived:

1. Vertical illumination.
2. Mean horizontal illumination.
3. Total illumination.

The relation between and the derivation of these three values is at once clearly suggested by a brief reference to the point by point method of figuring illumination. When the candle-power of a lamp in a certain direction is divided by the square of the distance to a certain point in that direction the result is the total illumination received at the point from the lamp. This value multiplied by the cosine of the angle of incidence with any plane gives the value of the illumination in a direction perpendicular to the plane. Thus, if the plane is horizontal the vertical value is obtained; if vertical, the horizontal. If several lights are considered the value of the combined illumination is equal to the sum of the values obtained from the individual lights.

Returning to the experimental determination of these values, the vertical illumination shown on curve

[1] Paper presented before Seattle Section American Institute of Electrical Engineers, Nov. 19, 1910.



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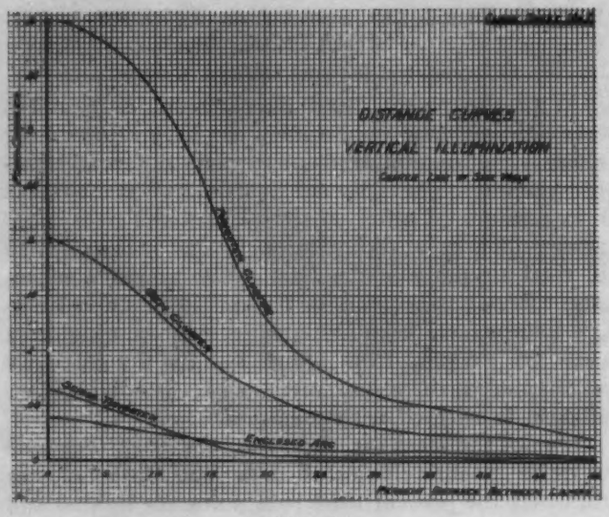

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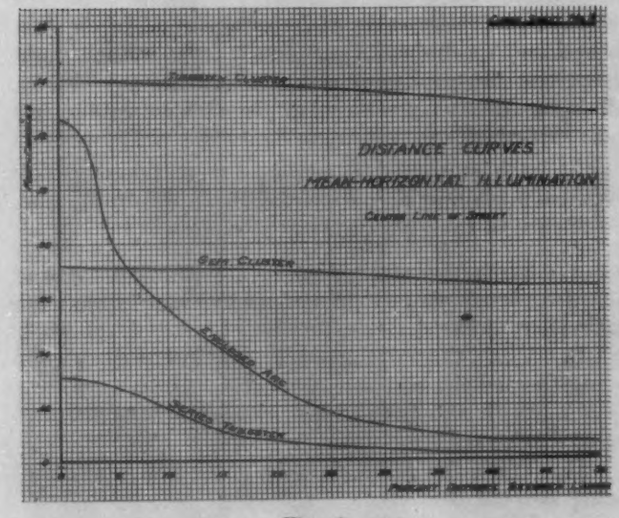

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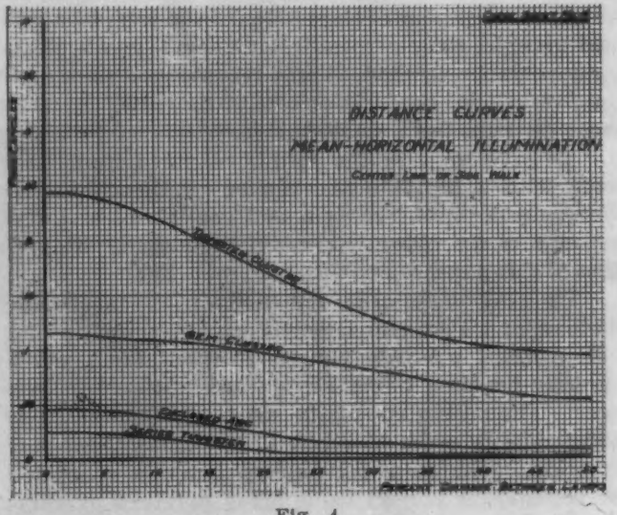
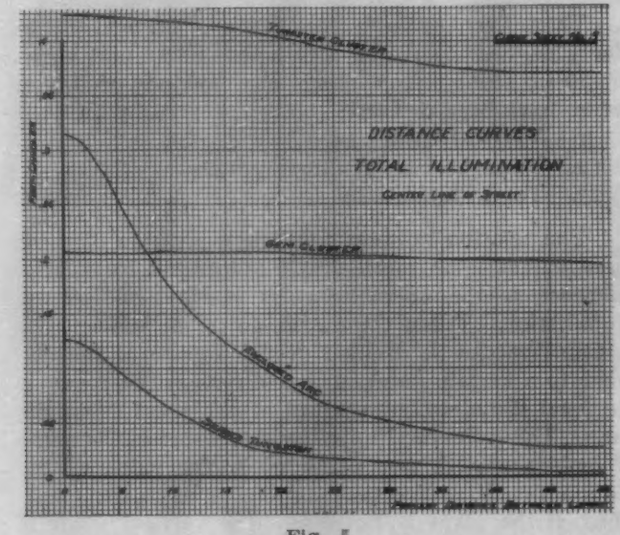


Fig. 4.



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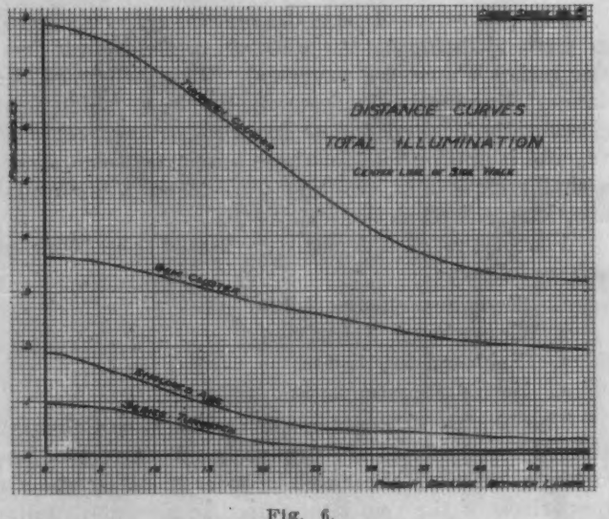

Fig. 6.

sheets Nos. 1, 2 and 7 is the E reading, above referred to, just as taken on the street.

The mean horizontal illumination shown on curve sheets Nos. 3, 4 and 8 is the mean of the A, B, C and D readings.

The total illumination shown on curve sheets Nos. 5, 6 and 9 is a deduction from the five readings using the equation.

Total illumination $= \sqrt{(A+C)^2+(B+D)^2+E^2}$

As is readily seen from the equation, the readings in

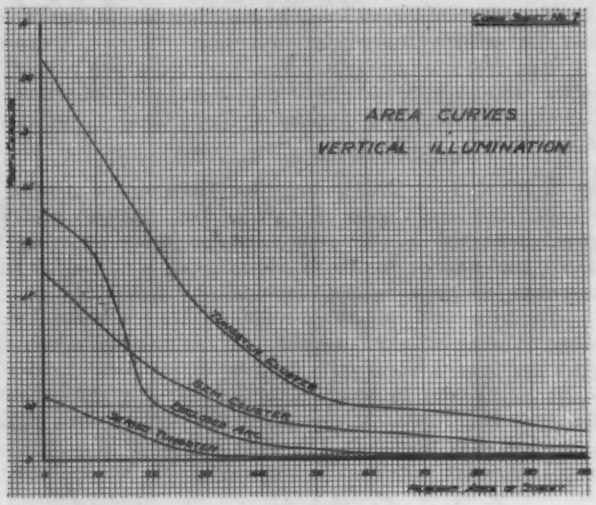

Fig. 7.

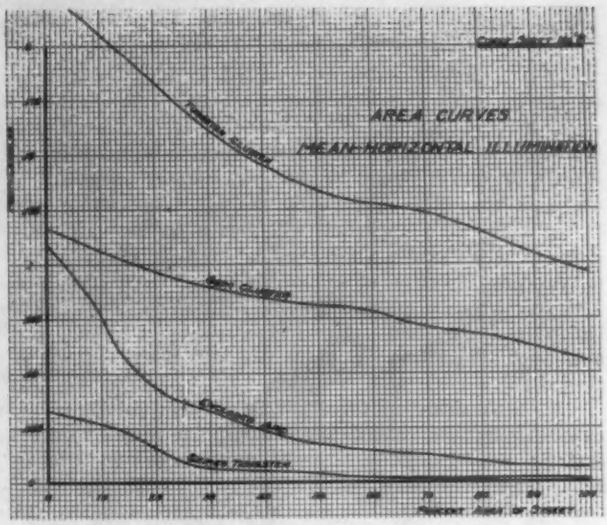

Fig. 8.

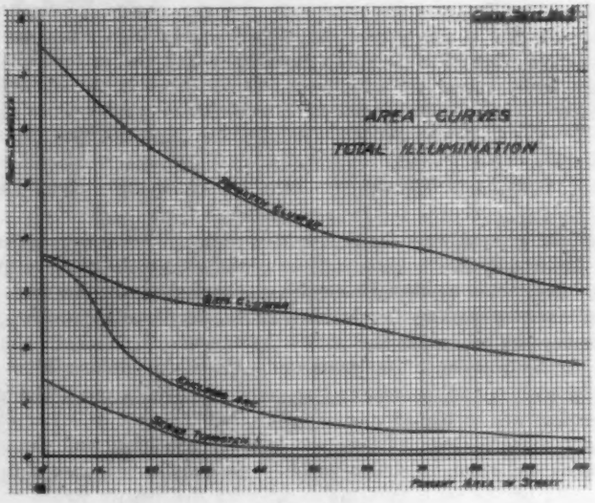

Fig. 9.

opposite directions have been added and their sums combined to form the diagonal of a cube, so to speak. Since no downward reading was taken the deduction which must necessarily result from reflection; but neglects the very small upward components of light these may well be neglected since they are not only of no value for illumination but are a positive hindrance.

This same value of total illumination is often obtained by one reading with a photometer equipped with a receiving device in the form of a sphere which receives light from all directions at once.

The results of the tests are shown graphically by means of two sets of curves, which from the nature of their abscissae, we refer to as:

1. Distance curves.
2. Area curves.

The ordinates are in both cases value of illumination in foot-candles.

The distance curves have for their abscissae per cent distance between lights along the line of set-ups mentioned above. Thus, referring to curve sheet No. 1, the vertical illumination, given by the tungsten clusters is 0.0425 foot-candles; gem cluster, 0.019; enclosed arc, 0.009; series tungsten, 0.002. This is, of course, at a point on the center line of the street in each case. At the point opposite this on the center line of the sidewalk, (curve sheet No. 2) we find the tungsten cluster 0.0825 foot-candles; gem cluster 0.041; etc. The per cent distance is used in place of the actual distance in feet in order that the four types of lighting, each having different lamp spacing, might be represented on the same sheet. It is to be noted that since the whole block was tested and all the readings plotted the irregularities that might occur throughout the block, from unequal reflection or other sources, do not appear in the curves. In other words, the curves show not the illumination between any two lights but the average for the block.

The area curves have per cent area of the street as abscissae. Thus, referring to curve sheet No. 7, one-fourth of the street is lighted (vertical illumination) by at least 0.165 foot-candles in the case of the tungsten cluster lights; 0.07, gem cluster; 0.04, enclosed arc; and 0.01, series tungsten. The data for these curves were derived from a large number of readings, some of which being taken on the center line of the street and on the center line of the sidewalk, appear in the distance curves. The derivation depends upon the fact that enough readings were taken regularly spaced over the entire block so that to each reading could be assigned a certain small area surrounding the station at which the reading was taken, each small area being, of course, a certain per cent area of the street. Hence the readings were arranged in descending order of their magnitude for ordinates and the corresponding per cent areas were progressively added for abscissae.

These same curves have often been obtained by plotting isolux curves and using a planimeter for obtaining the areas.

Examination for machinist is announced by the United States Civil Service Commission on March 29, 1911 to fill a vacancy in the position of machinist in the Signal Service at Large, Manila, Philippine Islands, at $1400 per annum. Applicants for this examination should be practical machinists, particularly experienced in the repair and construction of telephone, telegraph and electric-precision instruments.

DISCUSSION ON INDUSTRIAL POWER.[1]

The Electric Motor in Oil Well Service.

A. J. Bowie, Jr.: One of the questions Mr. Lamme brought up was the drilling of wells with rotary rigs. While these rigs work to advantage in soft formations, it is difficult if not impossible to use them when the formation is hard, in which event a drop drill should be used. The change from the Y to the delta connection for the motors is an interesting matter, as the higher field excitation will give a far stronger starting torque, and will enable a motor to deliver with advantage power considerably in excess of its normal rating for a short period. This results in nearly equalizing the copper and iron losses during the period of overload, and gives a rate of heating considerably below that which would obtain with the same load to be carried at the lower field excitation.

M. E. Lombardi: There is one question about the use of motors against gas-engines that I would like to ask about. The cheapest method of pumping wells, our company has figured, is a gas engine. Of course we get gas out of adjoining wells for nothing. Evidently the first year that will necessarily be cheaper than by the use of electric motors where you have to pay for the electricity. The second year it may be different on account of the large increase in repairs to the gas engine. Everybody knows that a gas engine is liable to have high maintenance charges after about a year's running, which the motors would not have, except for one thing. Down there in the oil fields, especially in the fall—they have tremendous wind storms raising large quantities of dust. It might be compared to a cement factory. And I would like to ask Mr. Lamme, or someone who has looked into the subject, what he has thought about that. The engine houses are loosely constructed, the high winds tear up the ground, and the dust comes in with tremendous power. I know that dust is commonly considered a great enemy to machinery. Has he thought anything about protecting the motors, whether by sealing the houses—which would cost considerable money—or protecting the motors themselves.

The question of maintenance is the main question between gas engines and motors, as long as the gas holds out. The gas engines are of higher cost to install, but they are of lower cost to operate so long as they are in good condition, and the gas holds out from adjoining wells. The question of dust storms would be the main thing as to whether the motors would have a high up-keep or not.

W. F. Lamme: I never thought of that. But I will say this: that we drive cement mills and stone crushing plants with motors. They require special bearings—dust-proof in many cases. The motor itself is not much troubled with ordinary dust. Cement dust is much worse than the ordinary kind. I don't think the ordinary dust would be much trouble. You must take the ordinary precautions to remove it once in a while.

M. E. Lombardi: If you put up a galvanized iron building and sealed it tight you would get rid of the dust; but in August the temperature is 120 outside and 140 inside.

W. F. Lamme: When you box a house up it is very bad for the motor. Some artificial means of getting air in should be furnished. We often see that in cases of deep wells, where it is rather close. I do not believe that it will occur in the oil fields of California. I do not believe that the dust is going to be so bad that it will be necessary. I think an ordinary house, with probably a screen on one side, would take care of the dust. If the worst should come we could build dust-proof bearings.

A. J. Bowie, Jr.: As to the protection of bearings from dust I have had a good deal of experience with motors running under similar conditions, and found it was a great help with vertical motors to filter the oil. I think some system of that kind might be devised for filtering the oil for the bearings.

S. G. Gassaway: I think Mr. Bowie is thinking of the oil that circulates in the bearings. As far as dust getting into motor bearings is concerned, when the electric motor is used in rock-crushing plants, I do not know of any place that is dustier than that, and we have no trouble with them.

Hugo Altmayer: We had some experience with motors out in the sand. We found by putting a tin can over the end of the bearings they ran along there about six months.

Electric Power for Gold Dredging.

J. W. White: Mr. Gassaway has taken up the question of the operation of dredgers with a head line, and also with digging spuds; and in this connection also spoke regarding the bucket ladder taking less power when digging at an angular position than when running idle horizontally.

To get around the undesirability of using a bucket ladder above or in the horizontal position, in a few instances a hydraulic giant has been mounted upon the bow of the boat, discharging water at the bank in order to break down that portion above the water line, so that it is caught by the buckets when digging at the bottom of the pond. The water for this giant is furnished by a multi-stage centrifugal pump, motor driven. By breaking down the bank by means of a hydraulic jet the daily yardage of the dredger is considerably increased without a greater total of power output; and the strains which are consequent upon the position of the ladder "when digging on the horizontal and in some instances above the horizontal when the bank is high" are eliminated.

Referring again to the head-line method of operation it is common practice to anchor a "dead man" four or five hundred feet ahead of the dredge, and the dredge swings on an arc with a radius equal to the length of the cable ahead. This method is usually employed in soft ground, and while it is cheaper in operating expense, is not as economical from the point of gold saving. The reason for this is that there is so much slack in the cable that the dredge does not dig on a true arc on account of soft spots in the ground, and more of the ground is lost than with a spud. If the ground is uniform and soft, however, this method may be successfully used.

If the dredge uses a spud in digging there is greater certainty of each bucket getting its proportion of the soil, and in hard grounds is much more satisfactory. The dredge has two spuds, one of which it digs on, and the other is only used with moving ahead.

In moving, the dredge is swung to the extreme end of the arc while on the digging spud; the moving spud is then dropped and the digging spud raised, and the dredge then swung to the opposite end of the arc. At this point the operation is reversed, and the dredge starts ahead on a new cut. It is therefore seen that the method of moving up is similar to a walking motion.

A number of tests have been made on different dredgers regarding the direct gearing of the motor to the bucket line, and it has been practically demonstrated that the strain on the gears at certain points is so great that general practice has reverted to belt drive again.

[1] San Francisco Section A. I. E. E., March 24, 1911.

BOOK REVIEWS.

Applied Thermo-Dynamics for Engineers. 438 pp., 6x10, 316 illustrations. By William D. Ennis. D. Van Nostrand Co., New York, and Technical Book Shop, San Francisco. Price $4.50.

This work is a technical treatise, covering the application and use of heat and heat engines. In the first eight chapters, the subject matter covers broadly the theoretical laws governing the nature and effect of heat. This section is divided into various groups, beginning with a study of heat units and specific heat and the laws of gases. Graphical representation of cycles and expansions are treated with considerable detail and a profusion of diagrams. The subject of entropy, so elusive to the lay mind is given an entire chapter and a mathematical treatment. The remainder of the book has many applications, beginning with the subject of compressed air with much valuable matter of a theoretical

nature. Hot air engines fill space that is conspicuously absent in older works covering this theme. The subject of gas power, producers and engines occupies 52 pages; it is complete and up-to-date and especially so in the number and variety of engines which is treated. The theory and design of the steam engine and turbine from the thermodynamic standpoint is most complete and supplies all of the information that one might require from a text or reference book. Finally, refrigeration and liquid-air are taken up with the same aim to thoroughness as is evinced throughout the entire work. Covering a broad and difficult subject with clearness and completeness this should be a satisfactory text book for the advanced student and a valuable reference for the engineer.

Design of Multitubular Boilers. 48 pp., 6x10, 15 plates. By James D. McKnight and Alfred W. Brown. D. Van Nostrand Co., New York, and Technical Book Shop, San Francisco. Price $1.50.

The subject of marine boiler design is one of the greatest commercial importance and yet it is, technically one on which little can be said outside of the set rules laid down by long construction experience; this is particularly so when reference is made to one particular type of boiler, as is the case here. The best idea of the object of the book can be had from the first few lines of the preface: "This treatise has been issued for the use of those engineers and draughtsmen whose experience has been wholly or mostly on engine work, but who are anxious to learn something of the boiler side of the business." The quantity and completeness of the information contained in this book, on the multi-cellular type of marine boiler, following English Survey requirements of the Board of Trade, Lloyds and the British Corporation, at once shows its value. The book is well supplied with outline and detail drawings for standard specified sizes and pressures, and should appeal, not only to the marine engineer, but to the designer and constructor. General discussion of theory and practice has been carefully avoided; the subject matter is concise and all calculations are arithmetical or in the simplest algebraic form. As a hand-book this little work, within its limited field, should be of great value.

Continuous Current Machine Design. 240 pp., 5¼x8½, 137 illustrations. By William Cramp. D. Van Nostrand Co., New York, and Technical Book Shop, San Francisco. Price $2.50.

Direct current is so generally used in every industry and for every purpose, and the rules and laws of its operation are so simple and obvious in comparison with those governing the use of alternating currents, that we spend most of our energies when making calculations to the study of the latter. Every year new treatises are written and much is said to advance our general knowledge of alternating current machines and transmission. On the other hand, the very simplicity of direct current machines and their use precludes the necessity of saying much that is new. For this reason, the details of what is really a highly developed science invariably get brief treatment, whether it be in text books on electricity or even handbooks. The manufacturers of direct current machinery have their own carefully worked out designs and the results of their testing and experimenting; but a treatise on the design and detail of this type of machinery is a book of which there has been a long felt need. This new book covers the subject in minute detail, the treatment throughout evinces the result on the part of the author of careful study and research with the object of supplying the reader with matter at once concise and sufficiently complete to give a full and comprehensive understanding of both, calculation and design. The book avoids the time-worn practice of illustrating a few typical machines which the technical reader has seen many times before, but is profuse in carefully worked out drawings and diagrams to properly illustrate the subject matter. The author opens with a chapter on the form of modern machines, which is followed by chapters on armature and magnet calculations. A chapter on temperature rise is of unusual value. The subject of armature winding while technically interesting is not particularly new, but the chapter on commutation is in itself worth the price of the book and should appeal to any electrical engineer or operator. Construction and design are comprehensively treated, both graphically and mathematically, and considerable attention is given to costs. The latter data apply to conditions as found in England as also does many of the details shown. The mathematical development of the theory is segregated in the appendix. The book is well worth a place in any engineering library and as a hand-book should be of value.

NEW CATALOGUES.

Bulletin No. 131, descriptive of the installation of the "Chloride Accumulator" for the Lake Hopatcong Yacht Club.

In Bulletin No. 4812, just issued by the General Electric Company, are described small direct current generators ranging in capacity from 1¼ to 20 kw.

The Westinghouse Electric & Mfg. Company has just issued a catalogue section on its Type 8 and SA distributing-transformers for light and power service up to 3800 volts.

The General Electric Company had recently issued a new Bulletin, No. 4811, describing its drum controllers. This bulletin contains descriptive matter and data in considerable detail, and supersedes the company's previous bulletin on this subject.

The January-February, 1911, Bulletin from the Ohio Brass Company contains valuable notes on coupling electric railway cars, a description of the new O-B extended trolley car, suggestions in the choice of high tension insulators and interesting data on mine haulage installations.

Bulletin No. 4813, just issued by the General Electric Company, describes an oil break switch adapted to use on alternating current series arc systems for sectionalizing feeder systems, cutting in and out transformers, and similar classes of service requiring a switch to be operated under load.

The General Electric Company recently issued Bulletin No. 4787, which is devoted to the subject of Wires and Cables. The publication should be of considerable service to purchasing agents, central station managers, and all having occasion to buy or use wire and cable for any service. The book contains much data but no prices.

"Electric Meters: How to Read Them," is the title of a very attractive and instructive booklet just issued by the Westinghouse Electric and Manufacturing Company. As the title suggests, the booklet is intended as an instruction in the reading of watthour meters for the layman. It is written in a popular style, easily understood by anyone.

The General Electric Company has just issued a revised Bulletin, No. 4791, which supersedes its previous bulletins on this subject, "Feeder Voltage Regulators." The bulletin describes the Company's regulators of the induction type and switch type, single and polyphase, hand operated and automatically operated. It contains connection and dimension diagrams, together with weights of the various regulators described.

The Westinghouse Electric & Mfg. Company has just issued sections 804, 805 and 806 of its detail catalogue. The new sections describe the complete line of insulating materials recently placed upon the market by this company. The lines described include treated and untreated cloths and papers for insulating purposes, and insulating and soldering fluid, including shellacs, varnishes, soldering acids, soldering paste, glue, cement, etc.

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Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Transmission Line Stability

It is of interest to note the steady improvement which has been made in line construction for the long distance transmission of power, during the last decade. The results of operation, with this branch of electrical science more perhaps than any other, are necessary to approve theories of proper design, and line practice has gradually evolved from that borrowed from the telegraph and telephone standards to a remarkable individuality of its own.

The past winter, during which an unusual amount of rain has fallen, and even yet continues, has been a most severe test on electrical transmission. In spite of this, there has, taking an average, been less interruption to continuous operation than ever before and it can only be attributed to the fact of the standard quality of work, materials and design at present in vogue.

Anti-License Jargon

We often hear of the power and educational value of the daily press and the evidences of both the good and the bad that it accomplishes are to found on every hand. Unfortunately even the well meaning may become an advisor with insidious influence, because of a painful ignorance of simple affairs, of those things which permeate our every day life, and too often go unnoticed. This very condition should give to the ordinarily intelligent person, some power of observation.

An example of well meaning but inexcusable hogwash, appropos the bill on the licensing of stationary engineers now pending before the California Legislature, appeared in the ordinarily conservative Chronicle during the past week.

The following remarkable extracts on the subject of explosions of small boilers is illuminating:

> Whoever hears of the explosion of one of these simple steam boilers ——? There are virtually no such accidents.

Could anything be more childlike. The experienced statistician would make considerable research before he would have the temerity to utter such statements and, if he, in his studies, should delve into the columns of the paper in question would perhaps find enough data to preclude such a possibility. Again:

> It is improbable that in one of these boilers sufficient steam could be generated to cause an explosion and at any rate on all boilers, there is a safety valve

No, brother, the millenium has not arrived; boilers will still explode if you let them. Perhaps you may see the time when they will not because you will have no need for steam or boilers; meanwhile our boilermakers are still busy.

But why abuse the safety valve, it has a heavy responsibility as it is, like other human productions, it does not inherit from its creator any claim to infallibility. Why not print over railroad time-tables: "All trains are guided to their destination on two rails, hence the impossibility of an accident"? Lastly:

> A licensed engineer is no more competent to run one of these ordinary hoisting engines, than any other sensible man.

The licensed engineer really has to have sense and he doesn't wear horns. Why not license the sensible man and there will not be so much chance of drawing

a blank? There are many readers equally as unobserving as the writer of these excerpts, who will become educated to this lop-sided reasoning, and it is more the pity because they and they alone will be the sufferers thereby.

Recall of the Judiciary

The Journal cannot but feel some sense of shame and regret over the action of the California Legislature in the matter of the recall of the judiciary. Here is a body of men that is the boasted result of our first direct primary. Its members were direct from the people. They were for the first time in the State's history, nominated by the people, elected by the people, and if ever a legislature should have spoken for and had full confidence in the people it was this one. After a spirited debate in which men of unquestioned honor and integrity appeared before the legislators in opposition to the recall of the judiciary, this body answered in favor of the recall. It was pointed out to the legislature that there was a healthy division of opinion among the people as to the wisdom of including the judiciary within the recall provision. And it must be said these protestants had much the better of the argument. The legislature was asked to submit the constitutional amendment in such a form that the people who believed in the recall as a general proposition might vote to the recall as applied to the judiciary might vote for it, and so that those who were opposed, in principle, against that proposition. One of the chief arguments of the proponents of the recall is that "A people who can be trusted to elect judges can be trusted to recall them," and yet this people's legislature loudly claiming that they were representing the people and that a majority of the people wanted the power to recall the judiciary, stubbornly and suspiciously tricked the people out of the right to vote on that proposition as a single proposition. Denied the people the right to say what they wanted. This "people's legislature" has refused the people the right to express their unbiased opinion on a question of vital importance.

It is difficult to conceive what defense the recalcitrant members of this legislature can make to the charge of dishonest trickery. They have acted like fools bent on the destruction of the reform they misrepresent. They confess lack of confidence in the people; they give the lie to their own claims; they tell the public to take the recall as to all officers or to leave it alone. They tell the people the voters are fools and don't know enough to discriminate, and they consolidate a proposition that has the full approval of the people, with another proposition upon which the people are divided and say in effect "You can't get what you want unless you take something else you don't want."

These sort of tactics make thinking men sick and disheartened, and force the question, "Is this sort of reform any better than the machine dominance we have left?"

In every civilized country in the world the judiciary is supposed to be independent of the sovereign. Recently it was charged—but as to the truth of the charge we know nothing—that by a star-chamber proceeding under the direction of the Emperor of Japan, a number of socialists were executed without a fair trial and a shudder went around the world. What is the difference between a court dominated by an emperor and a court dominated bya majority of the people, or a court dominated by a fear of the recall. The mere threat of a recall would not disturb the judgment of a brave and honest judge, but no brave and honest man would care to put himself in a position where he would be subject to the recall, no matter how unmerited the movement for a recall might be.

The result may not follow immediately, but it will eventually, that cheap and shallow men will seek the bench. We will then have judges, not deciding the law as they find it, but trimming a statute down here or amplifying and enlarging it there to meet what they may consider the popular conception of the law. When this day comes God help the country.

When the lowly Nazarene was dragged into the Hall of Judgment for examination, Pilate, after questioning Him refused to pass sentence, saying, "I find Him in no fault at all." There was no referendum in those days and no recall of the judiciary, but it was during the Passover and the people were entitled to the release of one prisoner during this feast. Washing his hands of the whole affair, disregarding his own conclusions based upon the law and the evidence, in answer to the demands of the populace he permitted the people to write the judgment of the court.

"And Pilate gave sentence that it should be as they required." "Take ye Him and crucify Him, for I find no fault in Him."

Here you have the first historical record of what results from yielding the judgment of the courts to the wishes of the people.

There is something so monstrously wrong involved in the recall of the judiciary that it seems as though thinking men who advocate it had for the time forgotten to think. This is no mere question of voting out of office a bad man whom you have voted in. To oppose it is not to declare that a people who have elected a public officer are unfit to remove him if he prove unsatisfactory. These questions, if they be questions at all, are far removed from the real issue. The only shield that stands between human liberty and the passions of men is the judiciary. Against this scutcheon every lawless force that curses free America has been battering for years. If they can break down this defense, if they can make noisy clamor and angry shouts and protests dictate the opinions of the courts then farewell to a stable form of government, farewell to liberty as we have known it. "But the honest and courageous judge will decide just as he would decide now." Honest and courageous judge! There will be none left. The only judge who will ever be the subject of the recall will be the honest man who dares do what he thinks is right despite the clamor. Honest and courageous men will no more seek the bench than would an honest and courageous man willingly put himself in a position where, innocent of crime, he could be charged with criminal offense. The men who would seek the bench would be the kind who never would be recalled. No man's legal rights or remedies would be safe in such hands.

PERSONALS.

A. J. Turner, engineer for the San Dimas Quarry Company of San Dimas, Cal., is at San Francisco.

H. C. Stoddard, superintendent of the Rogue River Electric Company of Medford, Ore., is at San Francisco.

Frank Somers, manager of the Century Electric Company of San Jose, was a San Francisco visitor this week.

H. C. Strong, president of the Ketchikan Electric Light & Power Company, of Ketchikan, Alaska, is a San Francisco visitor.

G. R. G. Conway has been appointed chief engineer of the British Columbia Electric Railway Company, Vancouver, B. C.

Thomas Mirk, of Hunt, Mirk & Co., returned last week to San Francisco after a trip to San Diego on engineering business.

C. R. Ray, president of the Rogue River Electric Company, has returned to his home at Medford, Ore., after making a tour of California.

Henry Doerr, who is interested in the California Electrical Construction Company of San Jose, recently visited the San Francisco branch.

F. F. Barbour, who recently became assistant to the president of the Pacific Gas & Electric Company, visited Sacramento during the past week.

Arnold Pfau, hydraulic engineer with the Allis-Chalmers Company of Milwaukee, Wis., is paying a visit to the San Francisco office of the company.

Benjamin Cunha has made application to the Board of Supervisors for permission to install an electric lighting plant for commercial business at Half Moon Bay, California.

E. C. Bradley, vice-president and general manager of the Pacific Telephone Company, has returned to his San Francisco office, after a Southern California inspection tour.

H. F. Dodge, division commercial superintendent of the Western Union Telegraph Company, has been at San Diego with a view to selecting a location for a new telegraph office.

W. H. Holabird of Los Angeles, who is receiver of the California Development Company and is interested in electric power enterprises, arrived at San Francisco from the East last Monday.

C. H. Gaunt, general superintendent of the Pacific division of the Western Union Telegraph Company, who is convalescent after a severe illness, recently went to Santa Barbara to recuperate.

W. R. Alberger, who is vice-president and traffic manager of the Oakland Traction, Consolidated, and a director in the United Properties Company, has gone to New York on business for the new holding corporation.

H. M. Byllesby, president of H. M. Byllesby & Co., of Chicago, recently arrived on the Pacific Coast to look over the various electric power and lighting plants owned by the Byllesby corporations in Oregon and California.

Oakey Meadows, who was for a number of years a Southern Pacific train dispatcher and later held a position with the Ocean Shore Railway, has been made chief, solicitor of the Western Union Telegraph Company at San Francisco.

George Washington Ferrier is the electrician of the new Scottish Rite Temple, which was opened last week on the corner of Van Ness avenue and Sutter street, San Francisco. It is a large stone structure of six stories equipped with lighting fixtures of the latest type. There are also ingenious special lighting effects, which are made use of in connection with the lodge work.

ITINERARY FOR ELECTRICAL JOBBERS' TRIP TO DEL MONTE.

The outgoing route to Del Monte, California, will be via the Santa Fe and Southern Pacific (Coast Line), on the train known as the Electrical Supply Jobbers' California Limited.

Date. April.	Day.	Day of Week.	Via A. T. & S. F. Ry.	
18th	1st	Tuesday	Lv. Chicago	8:00 P. M.
19th	2nd	Wednesday	Lv. Kansas City, Mo.	9:10 A. M.
19th	2nd	Wednesday	Lv. Newton, Kans.	2:15 P. M.
19th	2nd	Wednesday	Lv. La Junta, Colo.	10.55 P. M.
20th	3rd	Thursday	Ar. Albuquerque, N. M.	11:05 A. M.
20th	3rd	Thursday	Lv. Albuquerque, N. M.	12:00 M.
20th	3rd	Thursday	Ar. Laguna, N. M.	2.00 P. M.
20th	3rd	Thursday	Lv. Laguna, N. M.	3:00 P. M.
21st	4th	Friday	Ar. Grand Canyon, Ariz.	6:00 A. M.
21st	4th	Friday	Lv. Grand Canyon, Ariz.	7:30 P. M.
22nd	5th	Saturday	Ar. Los Angeles, Cal.	2:30 P. M.
23rd	6th	Sunday	In Los Angeles, Cal.	
			Via S. P. Ry., Coast Line.	
24th	7th	Monday	Lv. Los Angeles, Cal.	8:00 A. M.
24th	7th	Monday	Ar. Del Monte, Cal.	9:11 P. M.

Round trip tickets Chicago to San Francisco via the Santa Fe line and Southern Pacific, westbound, and returning via Route Nos. 1, 2, 3, 4, 5, 6, 7, 8; $79. This includes side trip to the Grand Canyon. Returning via Route Nos. 9, 10, 11, 12, 13; $94. Pullman fares with stop-over at the Grand Canyon and Los Angeles, thence to Del Monte, are $18.50 for lower berth from Chicago.

Special round trip fares to Pacific Coast points, leaving Chicago April 18, 1911. Dates of sale, Chicago, April 18, 19 and 20, 1911. Final return limit, June 30, 1911.

From	To Los Angeles, San Francisco, San Diego, via direct routes.	To Los Angeles, San Francisco, in one direction via Portland or Seattle.
Chicago, Ill.	$72.50	$87.50
St. Louis, Mo.	70.00	85.00
Omaha, Neb.	60.00	75.00
St. Joseph, Mo.	60.00	75.00
Kansas City, Mo.	60.00	75.00
Sioux City, Ia.	63.90	78.90
St. Paul, Minn.	73.50	81.75
Minneapolis, Minn	73.50	81.75
Memphis, Tenn.	70.00	89.65
New Orleans, La.	70.00	92.50
Denver, Colo.	50.00	65.00

For side trip to the Grand Canyon add $6.50.

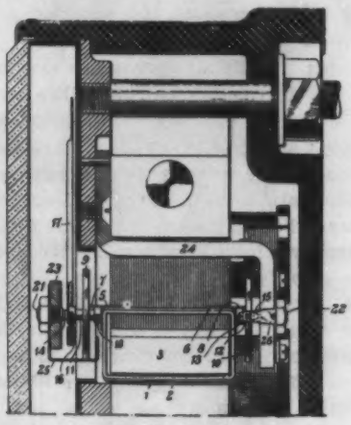
Going trip from Chicago must commence on day of sale; return trip must commence on date and train stamped on validation certificate. When presented in person by the original purchaser to the validating agent, tickets will be validated not to exceed one day in advance of departure. All tickets must read Chicago to San Francisco and return. The going coupons being "Santa Fe, Chicago to Los Angeles; S. P. R. R., Los Angeles to San Francisco."

Special rates are offered by the Hotel del Monte for the annual session Electrical Supply Jobbers' Association, April 25, 26, 27, 1911. Reservations will be made in the order received at the hotel office for accommodations which are available as follows: 32 single rooms without bath on fifth floors of annexes at $3.50. 52 rooms with and without bath on fourth floors of annexes at $4, one in a room, no bath; at $7, two in a room, no bath; at $4.50, one in a room, with bath; at $8, two in a room, with bath. 25 rooms without bath, main building back, at $4, one in a room; at $7, two in a room. Rooms with and without bath on first, second and third floors of annexes and second and third floors, main building, at $4.50, one in a room, without bath; at $8, two in a room, without bath; at $5, one in a room, with bath; at $9, two in a room, with bath.

A round trip to Yosemite Valley is offered at a flat rate of $28.65 by the Southern Pacific Company if a party of 125 is formed. This rate includes Pullman fare both going and coming and special train both going and return trips, all meals, sleeping accommodations while at El Portal and in the valley, and would permit members of the party spending three good days in the valley.

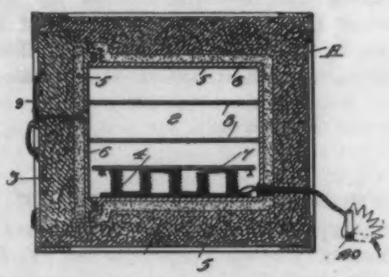
PATENTS

985,456. Electrical Measuring Instrument. Maurice C. Rypinski, Pittsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. An instrument pointer formed from sheet material



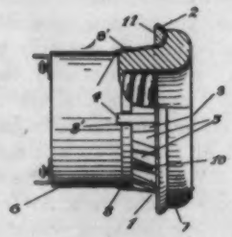
and comprising a channel-shaped index-carrying arm, and a base having a seat or recess in one side to receive a supporting member, and recesses in said base to receive material for balancing the pointer.

985,144. Electric Oven. James V. Chown, Oakland, Cal., assignor of one-sixth to R. Porter Giles, one-sixth to William S. Cox, one-sixth to J. Clem Ady, and one-half to Jessie Marian Chown, Oakland, Cal. An electric oven comprising a shell embodying a mixture of diatomaceous earth, sawdust and lime,



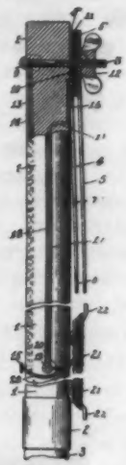
and having its interior lined with a coating of fire-clay, said composition and lining inclosing an oven chamber, a door of like composite material similarly lined closing said oven chamber, an electric heating coil for the oven, with means for regulating the amount of heat from the outside.

985,395. Lamp-Socket Fastening. Hjalmar Christensen, Seattle, Wash. A lamp socket fastening comprising a hollow body portion provided at one end portion with relatively long



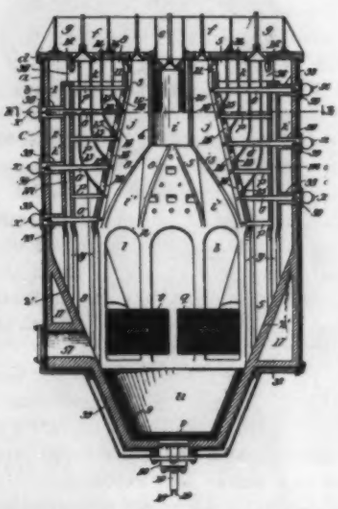
and short fingers, the longer of said fingers being pliable whereby they can be bent outwardly to oppose the supporting element for the lamp socket, and a shoulder on said body portion co-operating with the last named of said fingers to secure said body portion to the supporting element for the lamp socket.

985,127. Portable Telephone-Pole. George J. Bayless, Oakland, Cal. A portable telephone-pole comprising a pole; a pair of conductor arms pivotally connected with the head of



the pole and adapted to be extended from opposite sides thereof, said arms being electrically insulated from each other; and circuit wires leading from said arms.

985,226. Electric Smelting Furnace. Edward R. Taylor, Penn Yan, N. Y. An electric smelting furnace of the stack type having, in combination, a suitable hearth, a superstructure of suitable heat-resisting material inclosing a working chamber above the hearth and constructed with a cylindrical upper feed portion including a cylindrical outer wall and cylindrical walls concentric therewith forming between them



vertical feed passages for heat-conserving streams of ore on its way to the heat zone, a central circular wall inclosing a vertical flue-shaped coke passage and a downwardly flaring circular wall separating inner and outer ore passages surrounding said coke passage, and horizontal electrodes extending into the working chamber immediately above the hearth; said passages discharging in common into the working chamber by gravity.

INDUSTRIAL

O-B EXTRUDED TROLLEY EARS.

In the Extruded Trolley Ear which The Ohio Brass Company of Mansfield, Ohio, have just placed on the market, we feel warranted, by the unprecedented results secured by its use in severe trial service, in believing that we have at last found that for which railway men have been searching since the inception of overhead trolley, viz:—a means of greatly reducing the expense of trolley ear maintenance.

A glance at the accompanying illustration shows that the extruded ear consists of two pieces, a runner piece and a boss.

The boss is made of malleable iron, galvanized, and is pressed upon the runner piece and then securely riveted in place.

As the name would imply, the runner piece or portion which grips the trolley wire is made of extruded metal, which is a unique and most superior feature of the ear. A brief description of this extruded metal of which the runner piece is made, and how it is produced, will greatly aid in perceiving the good qualities of this trolley wire support.

A billet of pure cast bronze is placed in a furnace and heated to a bright red heat after which it is taken out and immediately inserted in a very thick walled, laminated steel drum having a tungsten steel die clamped against the opposite end of this cylindrical drum.

O-B Extended Trolley Ear.

This die has an opening in it exactly the shape of the section of extruded metal device which it is desired to produce and both the steel drum and tungsten steel die are especially designed to withstand enormous pressures at high temperatures.

A hydraulic ram is brought to bear upon this red hot billet of cast bronze forcing it out through the die under several tons of pressure. The metal, as it emerges from the die, is cooled rapidly by a very strong blast of cold air.

It can readily be seen that sections thus produced must be absolutely uniform in dimensions, and in the structure of the metal as metal so treated can not have any blow holes, cracks, checks or "rotten spots" which are sometimes found even in the very best of cast bronze material.

Referring to the physical properties of extruded metal we might state that it is due to this ingenious process of extrusion and not to the composition of the metal that the sections which we are putting into our ears have a tensile strength of 70,000 lbs. per square inch, an elastic limit of about 50,000 lbs. and an elongation of 33 per cent.

The above physical properties as given, coupled with the additional positive assurance that the sections must come absolutely true in dimensions, having a perfectly smooth surface for gripping the trolley wires, makes the metal peculiarly adapted for use as a trolley wire support.

Due to the fact that the metal is perfectly uniform as to physical structure and also that it has such great strength we are able to keep the lips of the extruded section which grip the trolley wire, very thin so that they offer the least amount of obstruction to the passage of the trolley wheel, thus minimizing the arcing of the trolley wheel when passing directly under these supports. Furthermore, this metal is capable of being easily hammered down to a perfectly smooth fit around the trolley wire without leaving crimps or bumps which would cause a continual chattering of the wheel in passing under them, as is often the case in cast ears.

The foregoing statements are based on actual experience and not alone on theory. We have been trying out this metal for sufficient time to make it absolutely certain that it would bear out in practice the superior points which it seemed to have in theory.

The practical installations we made proved conclusively that this ear has an exceptionally long life and furthermore that it causes less wear to trolley wheels than other supports.

Examinations of extruded ears that have been up for several months under the two-minute car service showed that the lips of these ears were tightly closed around the wire so that it was impossible to detect the actual joint between the lips and the trolley wire. Furthermore, the ends of the ears were found to grip the wire just as well as the central portion, instead of curling up as is often the case in cast ears.

One other advantage which is gained is the elimination of the possibility of the stripping of the threads in the malleable iron boss which often occurs in the bronze ears.

The malleable iron boss does not at any time come in contact with the trolley wheel, so it can not cause arcing.

Extruded ears are installed exactly in the same manner as any regular clinch ear and the lips are regularly furnished not tinned, but can be tinned if so ordered.

Any railway man will appreciate the fact that the extruded ear, due to its exceptionally long life will mean a great saving in his maintenance expenses, and due to its ductility and perfect fit it can be more quickly installed and will cause less wear to the trolley wheel.

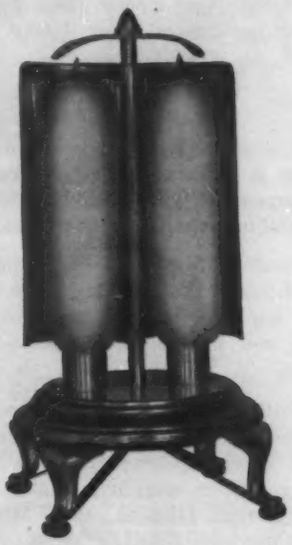
TWIN-GLOWER ELECTRIC RADIATOR.

Until it becomes customary to include special heating circuits in the wiring of our homes, the most successful heating devices will be those which are readily attachable to the lighting circuits in place of a lamp. In the twin-glower electric radiator recently developed by the General Electric Company, the feature of ready applicability appears to have been given first consideration in that the heating elements are designed for a maximum energy consumption of 500 watts, thus permitting the operation of the radiator on any lighting circuit.

It is noteworthy that in this case the feature of ready applicability has been obtained without sacrificing in the least the various well known advantages of the luminous type of radiators. The same "non-oxygen consuming" radiant heat so essential to hygienic conditions not only in the sick rooms of homes and hospital wards, but also for safeguarding the general health of any household is available, while extreme lightness of weight permits of the radiator being easily moved from room to room or to any other desired place. Thus it can be readily used for increasing the temperature of the bath room preparatory to the bath, for making the bedroom comfortable in the early morning when the regular heating system has a low tone, and for adding to the comfort of reception halls, libraries, studies, and other rooms, which usually are of temporary occupancy. Furthermore, the absence of

carbonic acid producing open flames renders its use particularly desirable in rooms containing valuable paintings and beautifully bound books, which rapidly deteriorate when exposed to injurious burnt gases or products of combustion.

The campaign of education on the advantages of electrical household devices has been prosecuted so successfully, that it is hardly necessary to repeat its many familiar and valid statements, yet any facts relative to the economy of these devices always are of vital interest to prospective users. In other words, they always like to know the price of a device and the cost of operation.



Twin-Glower Electric Radiator.

The price of the twin-glower electric radiator is only about a third more than that of the popular six-pound electric flat iron, and its cost of operation is about five cents an hour at the usual central station charge for current. It is, therefore, within the reach of all who desire to avail themselves of many comforts which are unobtainable economically by any other means.

Since these devices are only used for fractional parts of an hour, the monthly expense is comparatively small. Two and a half cents for protecting the baby from dangerous cold draughts during the bath is hardly more than the cost of the talcum powder dusted on the rosy skin, and about the same amount for comfort while getting up in the morning, thereby avoiding the necessitiy of starting the furnace an hour or two before breakfast certainly is a small item compared to the benefits enjoyed. Furthermore, the desired heat is as ever-ready for use as the brilliant rays of the beautiful Mazda lamp in the chandelier—requiring the mere turn of a switch to pour out in full intensity.

It is generally recognized that only a single trial is required for permanently establishing the electric flat iron, radiant toaster and disk stove as household necessities; likewise only one trial is all that is needed to add the twin-glower electric radiator to the popular trio.

THE IRON LOSS VOLTMETER.

The standardization rules of the American Institute of Electrical Engineers provide that in determining the ratings of alternating current machines or apparatus, a sine wave of alternating current and voltage is assumed. This suggestion has been adopted by practically all manufacturers as a basis for temperature and performance guarantees. The reason is obvious. The wave shape affects the iron loss and, therefore, the general performance of most apparatus. Practically every generator, except those designed particularly to give a true sine wave of voltage will produce a wave shape different from that produced by every other generator; and even with those designed to produce sine wave voltage at their terminals, the circuit will likely distort the wave so as to cause it to vary considerably from the true sine.

As it is impossible to make guarantees that will apply to all wave shape, and as there is no simple way of designating any wave shape other than a sine wave, the sine wave of voltage has been adopted as a standard in order that results may be compared intelligently.

Difficulties arise in attempting to correct test results for the deviation of the actual shape of wave used from the true sine shape. The actual shape of the wave requires special apparatus to determine and must be redetermined for every test, as the constants of the apparatus tested change the shape of the wave. After the wave shape is determined, the form factor must be found, a complicated calculation. Hysteresis loss is affected by the wave shape, while eddy current loss is not, which makes it necessary to separate these losses before the form factor correction can be applied.

Another factor affecting results to a large extent is the frequency of the testing circuit, and the correction for it is difficult. It is almost impossible, particularly where tests are made at a substation, to bring the frequency to normal, and consequently a large error in actual and comparative results may be introduced.

To get around these difficulties and provide a simple method of making transformer tests which are correct for normal frequency and sine wave shape voltage, the Westinghouse Electric & Manufacturing Company, of Pittsburg, has recently placed on the market the iron loss voltmeter, an instrument that is invaluable to a central station or laboratory requiring tests on transformers in terms of pure sine shape voltage and normal frequency. The purpose of the instrument is to make possible the adjustment of the voltage of a circuit of any voltage wave shape, and frequency above or below normal, to such a value that the effect is the same as

The Iron Loss Voltmeter.

that of normal voltage of sine wave shape and normal frequency. By the use of this voltmeter and any convenient means for varying the voltage of the testing circuit, practically any wave shape of voltage or frequency error can be compensated for in the test. This is accomplished by setting the index pointer of the iron loss voltmeter for the normal voltage at which test results are desired, and then adjusting

the voltage by means of a rheostat or other device until the moving coil pointer is on the zero mark.

It will be apparent that this method does not produce a true sine wave voltage of normal value, nor does it change the wave of the applied voltage, but it compensates so that the effect on the iron loss is the same as the normal sine wave would produce.

This method of testing is extremely accurate. The A. I. E. E. rules permit a deviation of the wave shape from the sinusoidal shape of 10 per cent, but this deviation is intended as a limit for the wave produced by apparatus guaranteed to produce a sine wave, and is not intended as a basis for tests. It has been shown that tests made on various wave shapes within the limits of the nominal sine wave may vary as much as 7.8 per cent above and 5.8 per cent below what would be obtained with actual sine wave voltage. It is evident, therefore, that tests made on any wave shape should be corrected to actual sine wave values. In making such correction by means of oscillograms, it has been found that tests obtained on different wave shapes give results the best of which vary as much as 2½ per cent. With the iron loss voltmeter a large number of tests of different transformers on a variety of commercial wave shapes show that the result obtained varies not more than one per cent from the result obtained on true sine wave and normal frequency. The time required for the test is also reduced to a few minutes.

In addition to the possibility of making iron loss tests on transformers and other inductive apparatus intended for connection in multiple with the circuit, the iron loss voltmeter can be used to determine normal exciting current and for making a reliable heat run. The normal exciting current is determined by correcting the shape of the wave by any convenient means until the iron loss voltmeter and an ordinary root-mean-square voltmeter indicate the same voltage. The voltage wave then has the same form factor as a true sine wave, and by suitable correction for frequency the normal exciting current is determined.

In making a heat run, the voltage is adjusted as in the iron loss test, until the iron loss voltmeter reads normal voltage, with full load current in the apparatus. Under such conditions both the iron loss and the copper loss are normal, and the results of the test can be depended on as representing the normal performance of the apparatus.

The advantages of this system of testing must appeal to every central station man operating a plant of any size. It permits simple tests to check the claims of manufacturers and to compare competing apparatus before purchase.

CEMENT THAT WILL STAND 3000 DEGREES F.

For many years engineers have experienced great difficulty in proper maintenance of brick settings of furnaces of all types. They have been compelled to depend upon the ordinary fire clay as a bonding material, and as this fuses at a comparatively low temperature, the bond between the bricks is rapidly destroyed and the result is that the cracks are opened up between the bricks, through which the gases of combustion enter, eventually weakening the brick and causing the walls to collapse. Every engineer realizes the annoyance and expense occasioned by occurrences of this kind.

Another feature which has been objectionable is the fact that refractory bricks become very porous on the surface and very soon the clinkers from the coals attach to the surface of the brick and in removing these with tools, the bricks are broken.

After several years devoted to research work on refractory cements to overcome these troubles, the H. W. Johns-Manville Company, New York, are now offering to the trade, a line of cements called J-M Refractory Cements for furnace setting of various types, cupolas, lining brass furnaces, assayers crucibles, oil burning, tilting and rotary furnaces and for patching and facing bricks in place in the fire zone under various conditions. These cements are rated to resist temperatures as high as 3000 deg. F.

They have also produced a coating for walls known as J-M Brickline Cement, which prevents clinkers from adhering and to seal the pores of the brick. Realizing that the conditions under which these cements are used, are variable, they have been made capable of modification to meet conditions as they come up and the Johns-Manville Company invite the trade to place before them any conditions that are troublesome and they will be very glad to make a careful investigation and offer suggestions which will tend to overcome the difficulty.

TRADE NOTES.

The Detroit Electric for 1911 is attractively illustrated and described in a handsome catalogue from the Anderson Electric Car Company of Detroit, Mich. This brochure is replete with fine half-tones and is well printed in two colors.

The Mt. Hood Railway & Power Company has been awarded the contract for furnishing electricity to the new Balfour-Guthrie Company mill at Portland. The mill will have a complete single drive motor installation and will use about 500 h.p.

The City Railway Company of Los Angeles has purchased from the General Electric Company the following machinery and other equipment: Two 1000-kw., 2-unit, 2-bearing motor-generator sets; one 2-unit, 3-bearing, 600-kw. motor-generator set; six 475-k.v.a., 15,000-2350-v., water-cooled transformers; three 300-k.v.a., 15,000-2350-v., water-cooled transformers.

R. E. Starkweather, contractor for transmission line construction, has completed the transmission and telephone line between Monterey and Salinas and between Salinas and Spreckels. His contract for the trolley and telephone line construction of the Oakland and Antioch railroad is well under way, Mr. Starkweather also superintending the actual construction of the road.

U. S. Judge Coxe of New York has issued an injunction against the Independent Electrical Supply Company of that city, restraining them from handling or disposing of a line of switch boxes manufactured by the Economy Switch Box Mfg. Co., of Cleveland, Ohio, these boxes containing knockout plugs which it was claimed infringed the Bossert Company's Patent No. 571,297, which was sustained by the Circuit Court of Appeals in June, 1910.

A. C. Downing, formerly sales manager of the Waverly Company, and at one time with the Studebaker Company on the Pacific Coast, has recently been retained by the Anderson Electric Car Company. Mr. Downing brings a broad knowledge and experience to the Anderson organization, having been actively engaged in the electric car business for more than nine years. Mr. Downing will be in charge of the commercial vehicle department of the Detroit Electric.

The Westinghouse Electric & Mfg. Company of Pittsburg, Pa., has recently placed upon the market its complete line of standard insulating material products. This includes both treated and untreated fabrics and papers, a complete line of friction tapes and rubber splicing compounds, together with the various types of insulating glues, cements and gums, all of which are used in its works at East Pittsburg, in the manufacture of their standard electrical products. Attractive sample books, Nos. 804-X and 805-X, together with Folder 4181, have been issued and may be obtained from the various offices of that company.

NEWS NOTES

FINANCIAL.

DORRIS, CAL.—Dorris has voted a $12,500 bond issue for a municipal water system.

VALLEJO, CAL.—The board has approved of the plan, profile and specifications for the laying of the new 14-inch water main from Fleming Hill to this city and the 8-inch main from Georgia street to Fourth street, South Vallejo; also the plan and specifications for the new municipal wharf to be built at the foot of Lemon street in South Vallejo.

INCORPORATIONS.

WILLOWS, CAL.—The Peoples Power Company has been incorporated by C. R. Wickes, D. A. Shellooe, W. H. Travis, W. E. Scearce, J. T. Green, A. H. Quatman and others, with a capital stock of $180,000.

VISALIA, CAL.—The Alpaugh Telephone & Telegraph Company has been incorporated by N. L. Wilson, T. G. Adams, C. E. Timmons, W. F. McFarland and M. G. McNeely, with a capital stock of $25,000.

ALBERNI, B. C.—The Alberni District Electric Light & Power Company, Ltd., has been incorporated by Dr. A. D. Morgan, W. G. McAllister, of this place. The new company will install fixtures and supply electric lights in all houses in this city.

TRANSMISSION.

NORTH YAKIMA, WASH.—This place will in all probability install a municipal lighting plant.

SILVERTON, ORE.—R. K. Page, of Salem, superintendent of the Portland Railway, Light & Power Company, is asking for a franchise in this city.

CALLAHAN, CAL.—The Scott River Dredging Company's plant here, was totally destroyed by fire last week. The loss is estimated to be $75,000.

WASHOUGAL, WASH.—The Mt. Hood Railway, Light & Power Company, Commercial block, Portland, has secured a franchise from the City Council to furnish power and light to the city.

TACOMA, WASH.—The Nisqually Power Company has granted a contract for the steel bridge and pressure pipe work on the substation in this city, to Hans Pederson of Seattle, Wash.

TACOMA, WASH.—The municipal commission has finally awarded a contract for completing the municipal hydroelectric plant on Nisqually River at La Grande to Hans Pederson, Madison building, Seattle, at $1,074,918.

FOREST GROVE, ORE.—The City Council has granted a franchise for 25 years to the Independent Electric Company for the transmission of current and the erection of poles over certain streets of this city.

SANDPOINT, IDAHO.—The Idaho Power & Concentrating Company will expend $52,000 in the spring in the erection of a power and concentrating plant at Trestle Creek, eight miles from this place.

HUSUM, WASH.—The Husum Power Company will shortly commence the erection of a concrete dam across the White Salmon River near the present intake to the power plant. An increase of 1000 h.p. will be available at the dam. It is probable that the main power plant will be enlarged extensively.

OROVILLE, CAL.—That another large power plant is to be located in Butte County was learned when a trust deed conveying 90,000 miner's inches of water on the Middle Fork of the Feather River was filed. The deed conveys the water to George H. Tully, H. B. Lind and M. P. Barnes, all of Sacramento. The rights were sold by M. E. and H. O. Lague, of Sparks, Nev. The rights are to be held in trust until such time as the Central California Hydroelectric Power Company is organized and financed to develop the water rights.

KOOSKIA, IDAHO.—It is reported that work will start in June on the construction of a huge dam at this point by eastern capitalists. The dam will be built across the middle fork of the Clearwater river and will cost $200,000; 5000 h.p. will be developed. The survey for the project was made by Engineer T. H. Croswell of Spokane and W. J. Bell of Newaygo, Mich., who drew up all specifications for prospective bidders. With the completion of the dam a pulp mill, sawmill and other industries will be established.

ILLUMINATION.

MARTINEZ, CAL.—The Great Western Power Company has been granted an electric lighting franchise in this city.

ELSINORE, CAL.—The City Council has passed an ordinance granting to M. A. Gardner and M. L. Cambern a franchise to construct and operate a gas plant here.

PORTLAND, ORE.—Bids will be received at the office of R. H. Thomas, Portland, until 5 p. m. March 23, for material to be used in the installation of electrical equipment in the school buildings.

LOS ANGELES, CAL.—A three-story brick building 100x100 feet at the corner of Fourth and San Pedro streets, has been leased for ten years by the Phoenix Lighting Fixture Company, and work of installing a manufacturing plant there will begin at once. It is expected to have the plant in full operation by April 1st.

ANAHEIM, CAL.—The sale of the controlling interest in the Orange gas plant has been announced by Manager Miller of the Orange County Gas Company, whose offices are in Anaheim. A Los Angeles corporation, it is claimed, is the purchaser. It is said that this new firm will renovate the plant, re-pipe the town and build a gas holder.

STOCKTON, CAL.—The Western States Gas and Electric Company announces that within 60 days Stockton will have a $1 gas rate. The rate for manufactured gas has been $1.50 per 1000 cubic feet. The rate for natural gas is $1 per 1000 cubic feet, with a 5 per cent discount on bills paid on or before the 10th of each month.

SAN BERNARDINO, CAL.—Bids for the lighting of the city's streets were not opened according to schedule at last week's council meeting. Instead bids were ordered held unopened for two weeks during which time an investigation is to be made of a certain proposition from the Lytle Creek Power Company, leading to the purchase of its system for a municipal plant.

FRESNO, CAL.—The recent removal of the headquarters of the San Joaquin Light and Power Company from Fresno to Los Angeles will not effect the general offices here, according to A. G. Wishon, manager of the company. He said: "The corporation was reorganized at Los Angeles because most of the stockholders are Los Angeles people, and it is inconvenient for them to come to Fresno for meetings."

TRANSPORTATION.

LOS ANGELES, CAL.—Dr. W. F. McBurney has petitioned for a franchise for a cross-town car line on Vermont avenue from Fourth to Vernon avenue.

FRUITVALE, CAL.—Plans are being made by the Oakland Traction Company to build a new electric car line on Redwood road, extending from the foothills to East Fourteenth street.

SALT LAKE, Utah.—Within ten days the Payson Electric Railroad Company, which is about to build an interurban electric line between Salt Lake and Payson, Utah county, will ask for franchises.

LONG BEACH, CAL.—H. C. Arnold has been granted a franchise for a scenic railway on Pike street, this city. The construction work will commence by April 1st and when completed, the road is expected to cost $85,000.

OAKLAND, CAL.—The Oakland Traction Company has applied for 35-year franchises on Clay street from San Pablo avenue to Eighth street; Market street from San Pablo avenue to Fifty-fifth street; Thirteenth street from Washington street to Market street and on Market street from Thirteenth to Fourteenth streets.

MODESTO, CAL.—The Modesto Board of Trustees has sold to the San Joaquin Valley Electric Railway Company a franchise for an electric road through the city. The franchise is for a right to lay tracks on Elm street and Eighth street. This is the first of two electric railways which will enter Modesto in the near future. The Tidewater and Southern Railway Company has applied for a franchise to operate a line from Merced.

TELEPHONE AND TELEGRAPH.

CHICO, CAL.—John Leaper announces that the Home Telephone Company is about to install its system in this city.

FRESNO, CAL.—The Vineland Telephone Company of Kerman, with J. C. Ashlin as president and R. S. Elliott as secretary, has been granted permission to erect telephone lines along the public streets and highways in this city.

MARTINEZ, CAL.—At a recent election the following were elected officers of the Pacific Telephone & Telegraph Company: Henry T. Scott, president of the Pacific Company; E. C. Bradley, first vice-president and general manager; E. J. Zimmer, second vice-president; Louis Glass, third vice-president, and F. W. Eaton, secretary and treasurer.

WATERWORKS.

SILVERTON, ORE.—The city of Silverton is calling for bids for the construction of a water and sewer system.

MADERA, CAL.—The City Trustees have let the contract for installing a complete water system to F. C. Roberts Co., Inc., of San Francisco.

TACOMA, WASH.—The Council has passed an ordinance providing for the construction of a six inch cast iron water main to be constructed in the city of Tacoma on Madison street, Gunnison street, Monroe street, and Tyler street.

LOS ANGELES, CAL.—Patton & Longley Company are placing on the market a tract of 800 acres in San Fernando Valley, and state that they are to install a complete free water system, including pumps, pipe and ditches at a cost of $15,000.

GRESHAM, ORE.—A serious mistake, made while testing the new pipe line near the Lusted school house, will prove costly and delay the completion of the line. It is estimated that the cost of replacing the ruined section will be about $5000. as new pipe will have to be secured.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has completed a three-foot raise in the Crystal Springs dam. The extra storage capacity of that body of water, nine miles long, with an average width of three-quarters of a mile, has been increased by 1180 million gallons.

JACKSON, CAL.—H. F. C. Fusier has filed on 100,000 inches of water on Amador county creeks as follows: Ashland Creek, 30,000; south branch Sutter Creek, 25,000; Golden Gate branch of Sutter Creek, 20,000; Pioneer branch of Sutter Creek, 25,000. The filings are for the volcano reservoir project.

PENDLETON, ORE.—At a meeting of the Board of Water Commissioners it has been decided to submit the question of bonding the city in the sum of $200,000 for a gravity water system, and as planned to include the construction of two reservoirs, one on the hills on either side of the river which run through Pendleton.

ONTARIO, CAL.—The City Council has received 14 bids for furnishing and laying pipe for the $175,000 municipal water system. Contracts were awarded to the Western Pipe Company at $16,397.90 for steel riveted pipe; Crane & Co., at $79,375.39 for screw pipe and specials and Joe Chutuk, Los Angeles, at $18,881.87 for laying pipes. Total cost, $105,685.21..

REDMOND, ORE.—At a meeting of the City Council to estimate cost of the proposed water system that Warren & Woodard, civil engineers of this city, had been asked to prepare, was submitted. The length of the pipe line from the reservoir to the city limits is two miles, and 10-in wooden pipe is proposed as the supply main for that distance, at a cost of $19,000.

ALAMEDA, CAL.—C. E. Gilman of the Union Water Company, the successor of the Bay Cities Water Company announced to Mayor Noy last week that the company would commence laying mains for the new Mt. Hamilton water supply within a few weeks. The 4 inch pipe for the domestic supply is all on hand, but the work of main laying will be held off until the 6, 8 and 12 inch crosstown mains arrive.

SAN FRANCISCO, CAL.—The first of the $45,000,000 Hetch Hetchy bond issue has been advertised by the Supervisors, bids for that amount to be received April 20th. The 60-day period is allowed to permit all parties ample time to make up their offers. The Supervisors despite the fact that the same amount was offered some weeks ago and after 30 days' notice received no bids, are confident that the securities will be sold this time.

SAN FRANCISCO, CAL.—The question of whether the Spring Valley Water Company is to be allowed to continue refusing to expend money for necessary extensions of its service on the plea that it is threatened with the city's competition is to be tested in the courts. This is the determination arrived at by the water rates committee of the Supervisors after a lengthy and at times warm discussion, in which Attorney E. J. McCutchen, for the company, flatly announced that the policy of the corporation on the point mentioned would be as stated.

JACKSON, CAL.—Edward Reckords of San Francisco has filed on 110,000 inches of water in the streams of Amador county. The filings comprise 25,000 inches in Panther creek, 25,000 inches in Mill creek, 25,000 inches in Tiger creek, 25,000 inches in East Panther creek and 10,000 inches in Antelope creek. Reckords also claims the natural flow, freshet and sewage waters running in those streams. The purposes stated in the filing are for irrigation, domestic, municipal and agricultural uses and for the generation of electric power in Amador, Sacramento, Calaveras and San Joaquin counties and as much further as practicable.